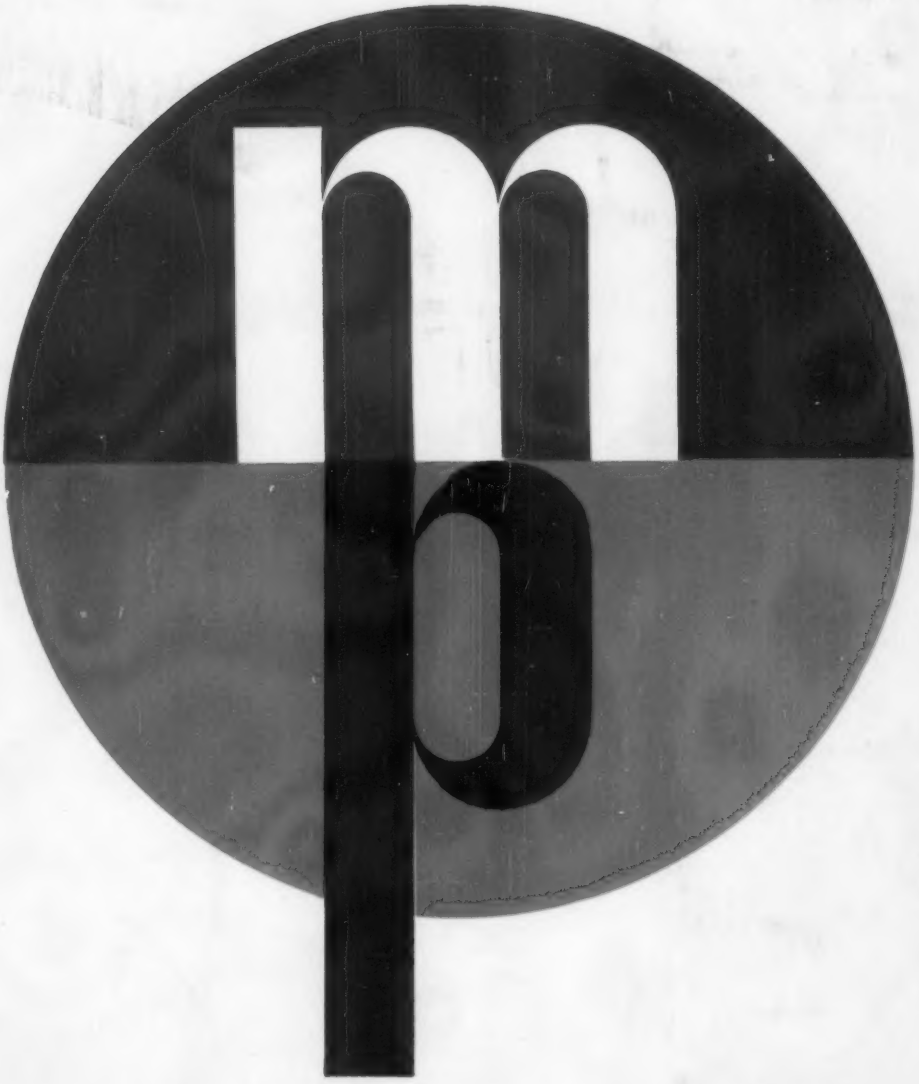
MODERN PLASTICS



July 1957

page 104 **What an atomic blast did to plastics**

page 115 **Rubber tools for reinforced plastics molding**

for these **important properties** in your products . . .



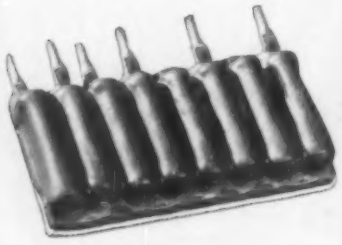
Bonding Strength of these resins is dramatically evident in chip-proof, split-proof molded products and board made from wood particles.



Acid Resistance makes Durez resin useful as base in cements and mortars for bonding acid-proof brick in tanks, vats and floors.



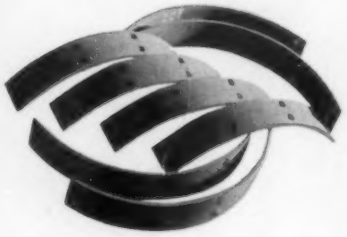
Heat Resistance of resins gives foundry shell molds hot strength sufficient for metal casting production.



Insulating Properties of resins are used in dip coating compounds to insure uniform resistance of small radio and TV components.



Compatibility of resin with nitrile rubber makes it a useful modifier. In GRS stocks it increases hardness and resistance to wear.



Wear Resistance of bonding resin prolongs useful life of brake materials. Resins also add resistance to heat, water and oil.

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MODERN PLASTICS*

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NEW PLASTIC REFRIGERATOR is lightweight, can be built as a wall-type or floor-type depending on customer's desires. Pilot model above, manufactured by Westinghouse Electric Corp., has 13 foot capacity.

Editorial

Polyester prices

As of July 1, 1957, two basic grades of styrene monomer will be available. One, so-called "rubber grade" or lower assay monomer, will be sold on contract with an escalator clause and should be available at somewhere between 12 and 13¢/lb.; the other, higher assay "polymer grade" monomer, will find its price level as a commodity at approximately 4¢/lb. more.

It is not our purpose here to discuss the pressures likely to be brought to bear on the polymerized styrene field, the styrene copolymer field, and the styrene alloy field by this new price arrangement. But let us consider the polyesters.

The same lower assay monomer that can be used for GR-S can be used to make many of the polyesters currently on the market. Pressures on polyester producers by those in the processing field for lower polyester prices are already building up. At a time when polyesters are still very small volumewise, when they are still unprofitable to the producers, and when so much needs to be done at both material-maker and processor level to bring the polyesters to big volume, lower prices for polyesters—in spite of styrene monomer at 12 plus cents—are unthinkable!

1) In the total composite of a polyester resin only between 24 and 33% is styrene monomer. The rest is one or more dibasic acids, catalysts, activators, polyhydric alcohols, inhibitors, etc., which are not going down in cost.

2) Of all resins, the polyesters are the most expensive to sell and service, not only because of their catalytic peculiarities, but because of the fact that they are generally involved with a wide variety of reinforcements and a wide variety of processing techniques.

3) Rather than lower cost polyesters, what this industry needs are new systems of curing, new attention to flame resistance, new research on weathering, and a great deal more work on environmental properties in application. All this must cost money—on top of the already high sales-service cost factor relating to polyesters.

The price of polyesters went up 1¢/lb. on April 1. If that price had gone up 3 to 5¢/lb. there would have been a margin for price adjustment of finished resins to meet the psychological pressures coming from lower styrene monomer costs. That one cent raise now leaves no margin for lower polyester prices.

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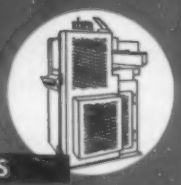
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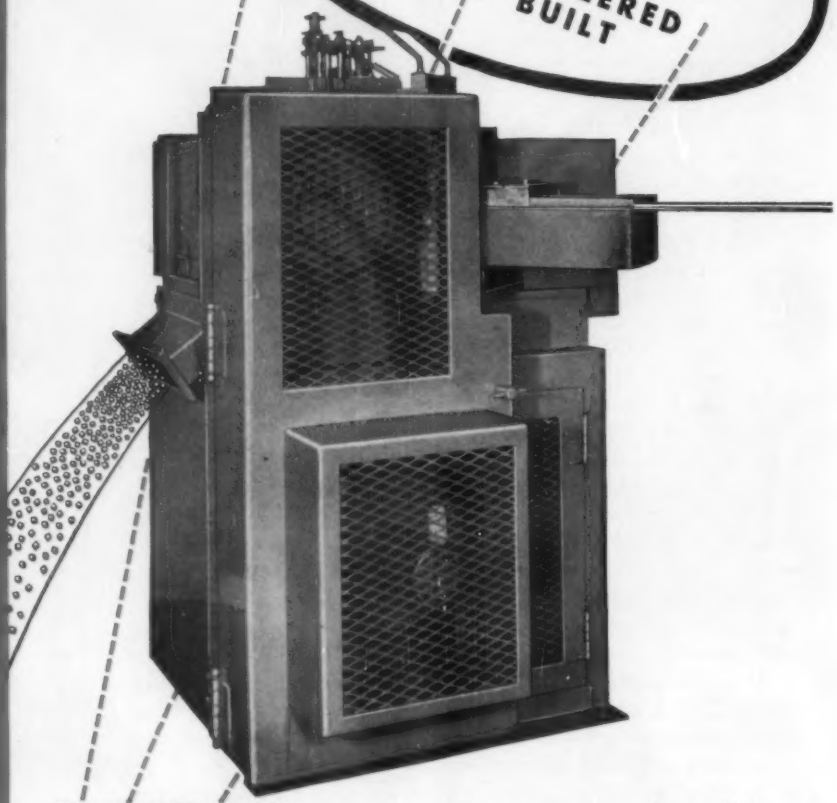
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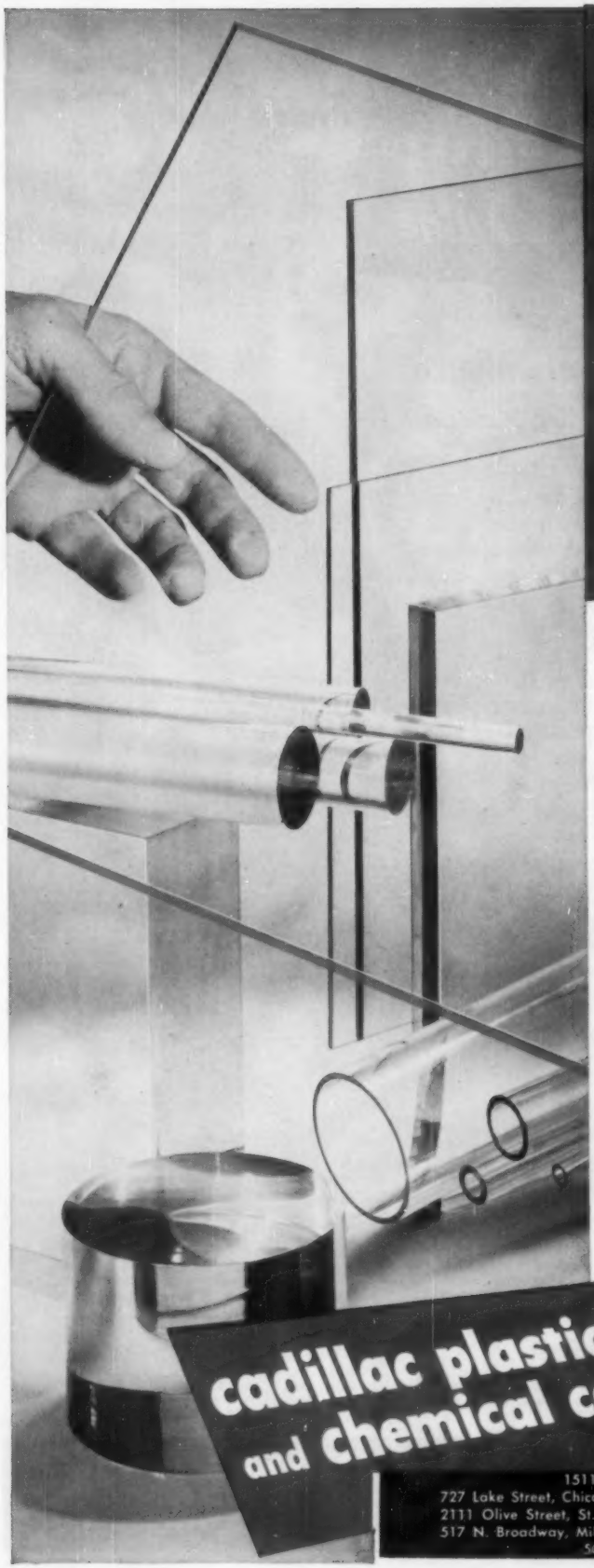
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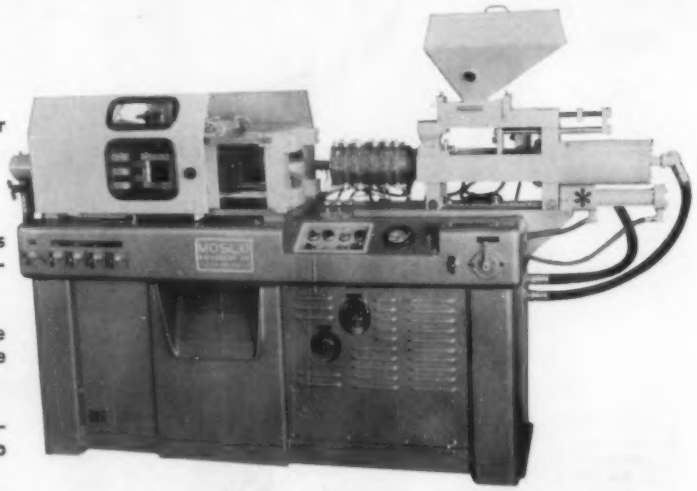
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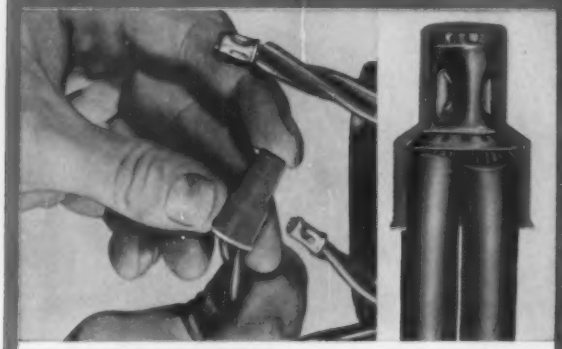
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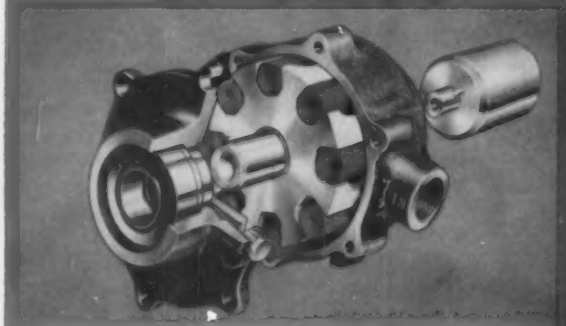
TEMPERATURE SELECTOR DIAL on steam iron is molded of black ZYTEL. Injection-molded dial has good strength, highly polished surface and is unaffected by heat of ironing. (Iron by Sunbeam Corp., Chicago, Ill.; dial by the Richardson Co., Melrose Park, Ill.



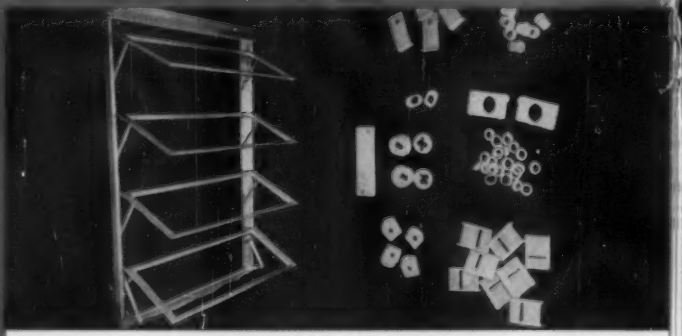
INSULATING CAPS depend on strength and resilience of thin-walled ZYTEL. Caps snap on and lock over electrical splices. (Molded by Stimsonite Division of Elastic Stop Nut Corporation of America, Chicago, Ill., for Buchanan Electrical Products Corp., Hillside, N. J.)



FOUR-TEMPERATURE SWITCH used for heating pad is molded of Du Pont ZYTEL nylon resin. A five-year guarantee is issued with each switch — proof of the manufacturer's confidence in the strength of ZYTEL. Du Pont ZYTEL is very strong even in thin sections. (Switch components by Wilmington Plastics Co., Wilmington, Del., for Saxony Electronics, Inc., Wilmington, Del.)

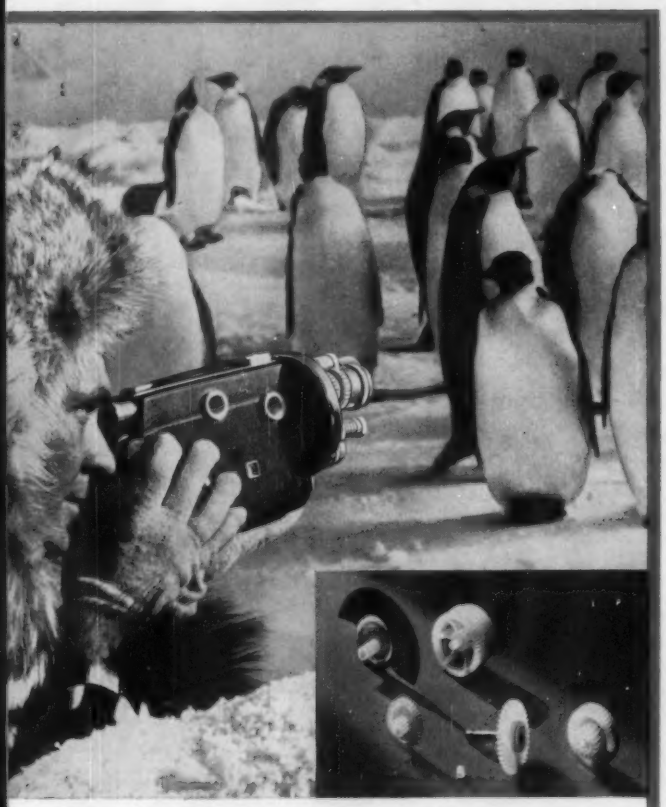


PUMP ROLLERS of ZYTEL are unaffected by farm chemicals handled by this tractor pump. The rugged rollers resist wear even when pumping suspension liquids. (Rollers molded by Minneapolis Plastic Molders for Hypro Engineering Co., both of Minneapolis, Minnesota.)

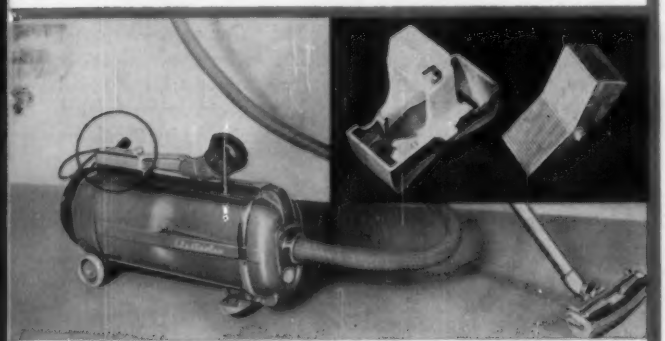


ALUMINUM AWNING WINDOW uses parts of ZYTEL nylon resin at all points of friction. Smooth, hard bearings of ZYTEL need no oiling. ZYTEL has outstanding resistance to wear and abrasion, and cannot rust. ("Look" window by Vun Russ Company, Inc., Hialeah, Florida.)

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FOOT-SWITCH COMPONENTS made of Du Pont ZYTEL provide high impact strength, excellent insulation, resistance to heat. (Vacuum cleaner by Electrolux Corporation, Old Greenwich, Connecticut; switch parts by Mack Molding Company, Inc., Arlington, Vermont.)

The products shown here rely to a great extent on the well-known strength of parts made of ZYTEL. In every case, however, it was strength plus one or more of the extra advantages offered by ZYTEL that gave the designer the cue to a complete solution of his problem.

For example, most thermoplastics lose their rigidity when heats of 200°F. or more are applied. The polyamides, and outstandingly ZYTEL nylon resin, are a notable exception. ZYTEL is rated for intermittent operation up to 250°F. For continuous operation at such elevated temperatures, heat-stabilized grades are available. As a thermoplastic, ZYTEL can be injection-molded, making possible high volume of production, low costs and low material losses. ZYTEL is moldable to close tolerances and usually needs no after-finishing.

In end use, ZYTEL offers many advantages. It is one of the lightest of plastics (sp. gr. 1.14), and rates among the highest in tensile strength. ZYTEL has excellent characteristics for gear and bearing applications. It is durable, non-brittle and corrosion-proof. Parts of ZYTEL need little or no lubrication. The material has good electrical-insulation properties, provides exceptional resistance to abrasion, and is inert to most common chemicals.

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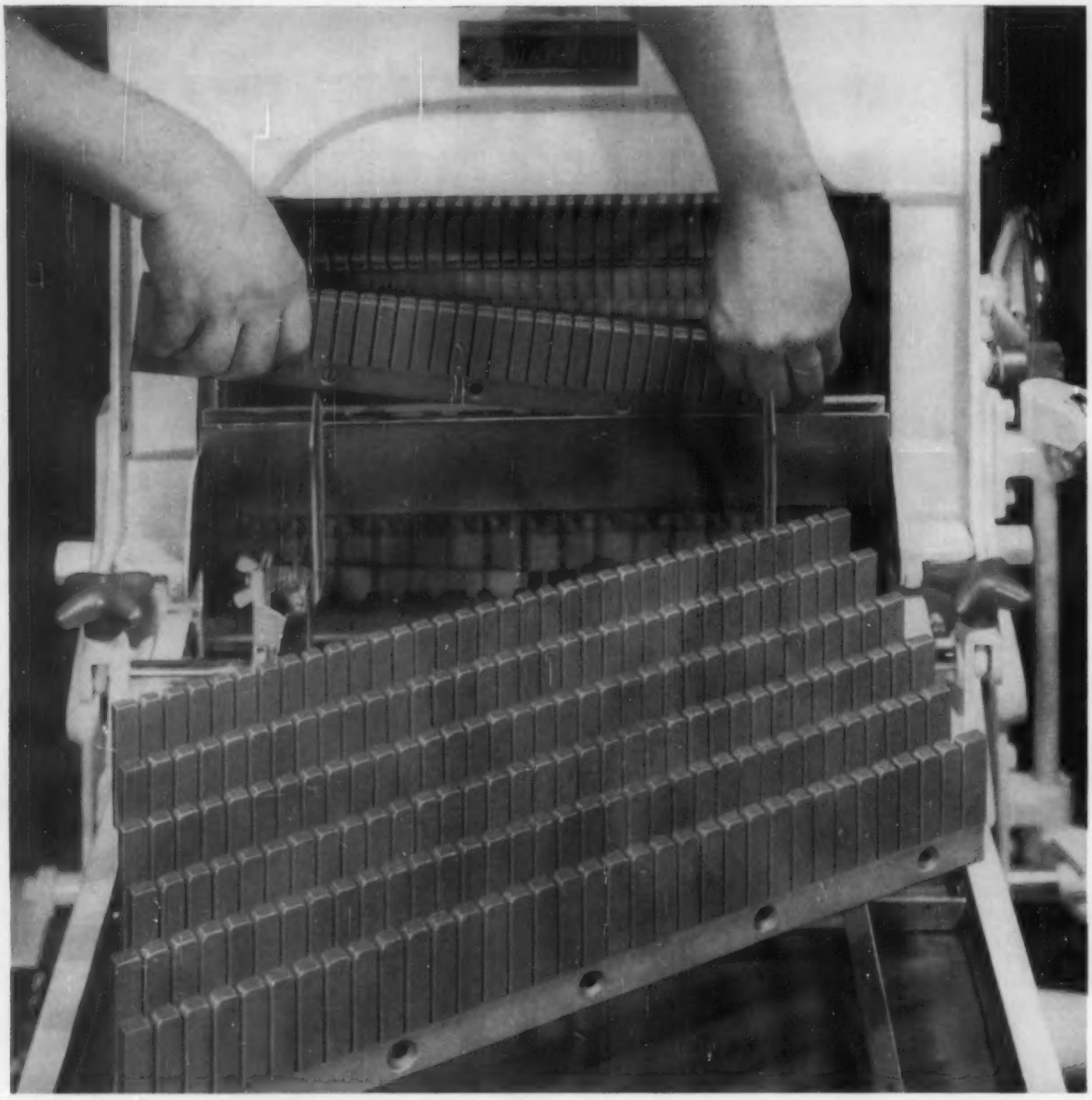
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In Canada: Du Pont Company of Canada (1956) Limited, P.O. Box 660, Montreal



NO MATTER HOW YOU SLICE IT—The equalizer blade guide bearings for this AMF Micro Jr. Reciprocating SLICE MASTER—a commercial bread slicer manufactured by American Machine and Foundry Company—required a highly specialized material for several extremely important reasons. First of all, the bearings had to be self-lubricating, yet able to withstand considerable heat caused by friction. Secondly, they had to be strong and wear-resistant, but could not dull the blades with which they came in contact. Finally, the bearings had to be easy to clean to avoid contamination of edible materials. For this particular job, AMF selected Synthane—a laminated plastic made and fabricated by Synthane Corporation and in which Mount Vernon fabrics were used.

This is another example of how fabrics made by Mount Vernon Mills, Inc. and the industries they serve, are serving America. Mount Vernon engineers and its laboratory facilities are available to help you in the development of any new fabric or in the application of those already available.

UNIFORMITY Makes The Big Difference In Industrial Fabrics

Mount Vernon Mills, inc.

A LEADER IN INDUSTRIAL TEXTILES

TURNER HALSEY COMPANY *Selling Agents*

Main Office and Foreign Division: 40 Worth Street, New York, N. Y.
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WE PROVED IT!

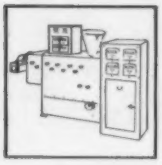
Since this advertisement ran with actual sample attached, inquiries keep pouring in asking,
"Where can we get it?"

CAN YOU SUPPLY IT?



Here Is What You Need To Produce This

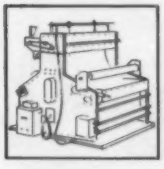
PRINTABLE POLYETHYLENE FILM with CELLOPHANE CLARITY:



MPM *Extruders* are recognized throughout the world for their superiority in providing greater, better, speedier and more dependable production day-in and day-out. MPM Extruders have exceptional versatility with all types of extrusion material and for extruding such products as Blown Film, Flat Film and Sheeting, Wire covering or Controlled Dimension Plastic Pipe.



NEW MPM *Treater** embodies the very latest technological developments for making the film surface receptive to all presently used film printing processes. The MPM Treater is particularly effective in processing the new polyethylene formulations having "slip" and "anti-static" additives. Ease of operation and low voltage along with high safety factor of insulation, insures maximum safety of operation. Treatment is certain and controllable.



MPM *Takeup* Pulls off, trims and reels the film, completing the production all in one continuous operation and as fast as you care to extrude.

MPM BUILDS 100% COMPLETE "PACKAGED UNITS"

*Protected by patents and patents pending.

mpm

modern plastic machinery corp.

Manufacturers and Designers of

THE MOST ADVANCED PLASTIC PROCESSING EQUIPMENT

15 Union St., Lodi, N. J., U. S. A. • Cable Address: MODPLASEX

IN USE IN THE UNITED STATES AND THROUGHOUT THE WORLD

West Coast Representative: 8510 Warner Drive, Culver City, Calif.


New resin with
TECH-BOOK FACTS
PLIOVIC S70 Medium Viscosity - General Purpose - Vinyl Resin

clear advantages

From the photograph at left, it is readily evident that sparkling clarity is one of the advantages offered by PLIOVIC S70. But once you've tried this newest of the custom-made vinyl resins by Goodyear, you'll find several other major benefits in its use, particularly in calendering applications.

PLIOVIC S70 is a medium viscosity, polyvinyl chloride resin. Its fine, uniform particles permit an ease of compounding which includes effective incorporation of all commercial plasticizers and stabilization with barium-cadmium, tin or lead systems equivalent to that obtained in higher molecular weight polymers.

The medium viscosity of PLIOVIC S70 also permits improved plastic flow and generally improved processing at *moderate* temperatures. In calendered goods, these processing advantages result in the following end-product improvements: 1. Excellent surface 2. Good gauge uniformity 3. Improved color uniformity 4. Good lay flat 5. Excellent heat sealability.

In addition to calendered goods, versatile PLIOVIC S70 can also be used to advantage in critical molded and extruded applications. Moreover, it offers an excellent means of modifying or "tempering" high modulus stocks for greater utility of equipment and production of a wider range of products.



Why not learn more about the clear advantages of PLIOVIC S70 and how they may solve your critical processing problems? The way to do it—and to learn more about the established members of the PLIOVIC family plus newcomers in the offing—is to write for full details, including the latest *Tech Book Bulletins*, to: Goodyear, Chemical Division, Akron 16, Ohio.

PLASTICS DEPARTMENT

CHEMICAL GOODYEAR DIVISION

CHEMIGUM • PLIOFLEX • PLIOLITE • PLIO-TUF • PLIOVIC • WING-CHEMICALS

High Polymer Resins, Rubbers, Latices and Related Chemicals for the Process Industries

Chemigum, Pliolite, Plio-Tuf, Pliovic—T. M.'s The Goodyear Tire & Rubber Company, Akron, Ohio





DEPENDABLE DISPERSION!

DRAMATIC COLOR!

MATCHLESS QUALITY!

masterColor COLOR CONCENTRATES

master batch color concentrates for polyethylene, polystyrene, high impact polystyrene, vinyl. Amazing variety! Exciting special effects! Custom colors you never believed possible... plus a choice of 8 great standard colors! Never any dusting... never any color contamination! MASTER COLOR offers unusual new opportunities and matchless economy for compounders, extruders, film processors, blow molders.

Kromaplast DRY COLORANTS

dry colorants for injection molding and extrusion.

Opens up limitless new possibilities for in-plant coloring of thermoplastic molding compounds! Easy ... reliable ... effective! Handsome special colors ... dramatic special effects! Standard colors that set new standards for clarity and fidelity! Light-fast, heat-resistant, non-bleeding!

Now ... new economy and exceptional fidelity of color for thermoplastic compounders, extruders, film processors, injection molders! Colors proved in actual use in our own color compounding operations. Complete control from initial pigment development through manufacture of the color concentrates enables us to make MASTER COLOR and KROMAPLAST always uniform ... always more satisfactory ... ... always most economical!

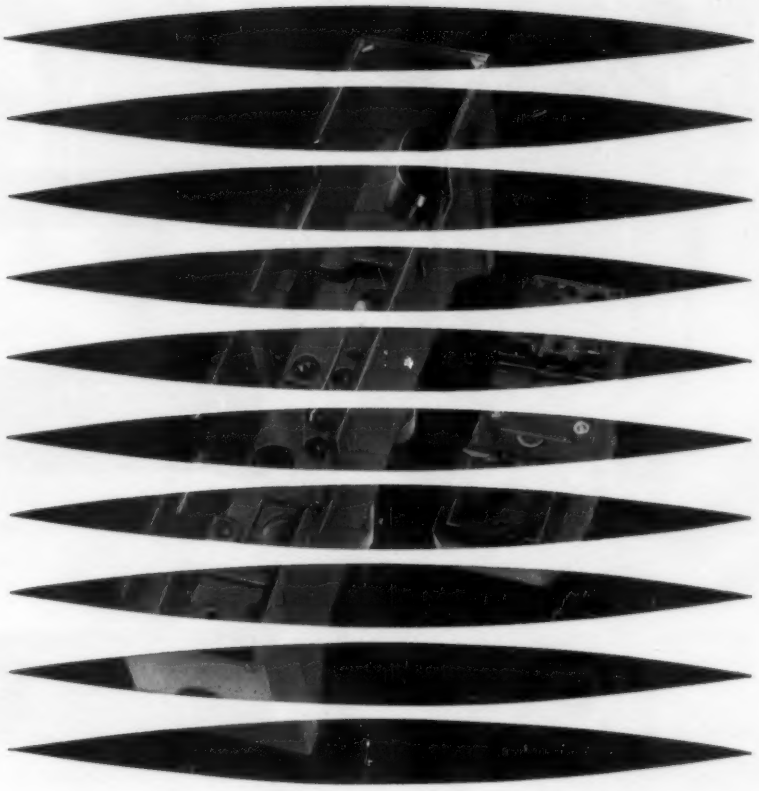
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AMERICAN MOLDING POWDER AND CHEMICAL CORPORATION

703 BEDFORD AVENUE, BROOKLYN 6, N. Y.

MANUFACTURERS OF AMPACET THERMOPLASTIC MATERIALS **CUSTOM COMPOUNDING** TO YOUR SPECIFICATIONS **WRITE FOR SPECIFICATIONS AND DETAILS**

PHONE: MAIN 5-7450 • CABLE: **CHEMPROD BROOKLYN** • **CHICAGO OFFICE:** 5850 NO. CLARK ST., CHICAGO, ILL. • TEL.: LONG BEACH 1-0419-20



how expensive are molds for plastic parts...really?

Take another look at this part. It has been in production over a period of thirty years . . . and not one cent has been charged to the customer for mold repairs! This molding which Kurz-Kasch has furnished Bulldog Electric Products Co. by the thousands since 1927, is excellent proof that *paying enough at the outset* for the right molds is a real bargain.

Sure, good molds cost money initially. But it's an unvarying policy at Kurz-Kasch to design and build original molds for easy repair, so that we—not the customer—pay the bills for mold maintenance.

For a quote you can depend on . . . to give you lowest final cost per part . . . call Kurz-Kasch.



Specialists in thermo-setting plastics for 41 years

kurz-kasch

Kurz-Kasch, Inc., 1415 S. Broadway, Dayton 1, Ohio

SALES OFFICES—New York, Mt. Vernon, Mo 4-4866; Rochester, Hillside 0626; Beverly, Mass., Walker 2-0065; Chicago, Merrimac 7-1830; Detroit, Jordan 6-0743; Philadelphia, Hilltop 6-6472; Dallas, Lakeside 6-5233; San Gabriel, Cal., Atlantic 7-9633; St. Louis, Parkview 5-9577; Atlanta, Cedar 7-5516; Toronto, Can., Oliver 7966





Five cylinder series... each the best of its kind!



Here you see one more reason why experienced cylinder users prefer Hannifin cylinders...there is a Hannifin cylinder series for every type of service.

What pictures cannot show you is the extra effort that goes into every Hannifin cylinder, all the way from the drawing board to the shipping dock. This brings you design features other cylinders simply do not have...superior workmanship where it's most needed for long, trouble-free service...and better delivery promises, better kept. All at prices no higher than you may have been paying for less satisfactory cylinders.

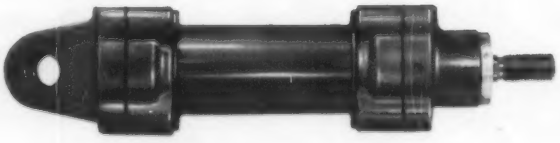
There's a Hannifin man near you—or, if the need is urgent, call us long distance. He or we will welcome the opportunity to help you as you select the Hannifin cylinder series that best meets your needs.



AIR AND HYDRAULIC

HANNIFIN

POWER CYLINDERS

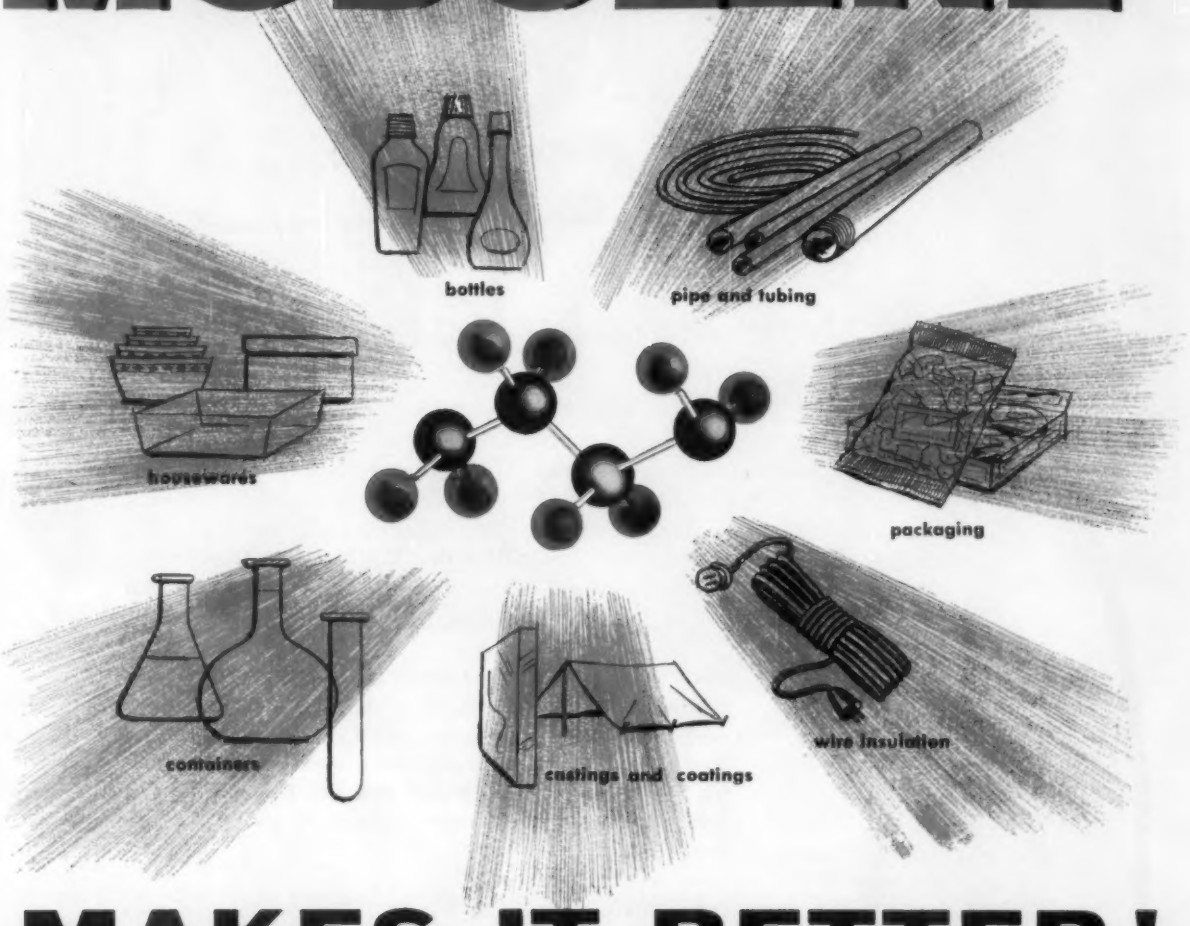


COMPLETE CYLINDER FILE

Write for your copy of this new Hannifin Cylinder File...complete, easy-to-use, easy-to-order-from information on five lines of Hannifin cylinders. Write Hannifin Corporation, 553 S. Wolf Road, Des Plaines, Illinois.



MODULENE*



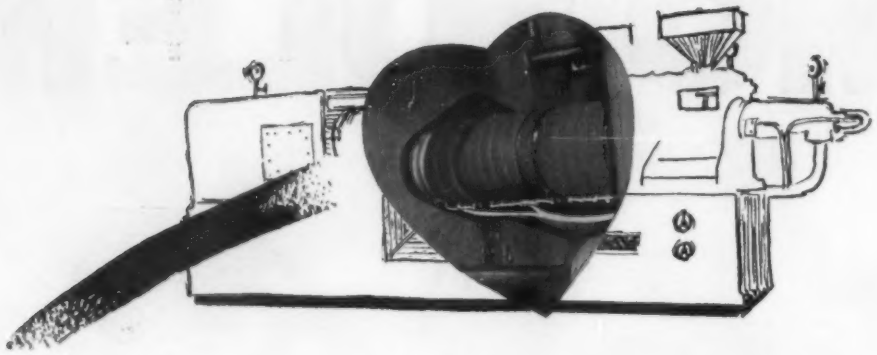
MAKES IT BETTER!

Whatever you make with polyethylene, Muehlstein's Modulene helps you make it better. For extrusion or injection molding, Modulene's superior properties offer improved product design and lower production costs. It has outstanding low temperature flexibility and toughness, superior chemical inertness, freedom from taste, odor and toxicity, excellent dielectric properties, low specific gravity (.92) and low water vapor permeability. Call on Muehlstein today, and find out how Modulene can improve your product design.

*A Virgin Polyethylene manufactured by Koppers Company, Inc.

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REGIONAL OFFICES: Akron • Chicago • Boston • Los Angeles • Toronto • London
WAREHOUSES: Akron • Chicago • Boston • Los Angeles • Jersey City • Indianapolis



"Your injection machine has a heart too"

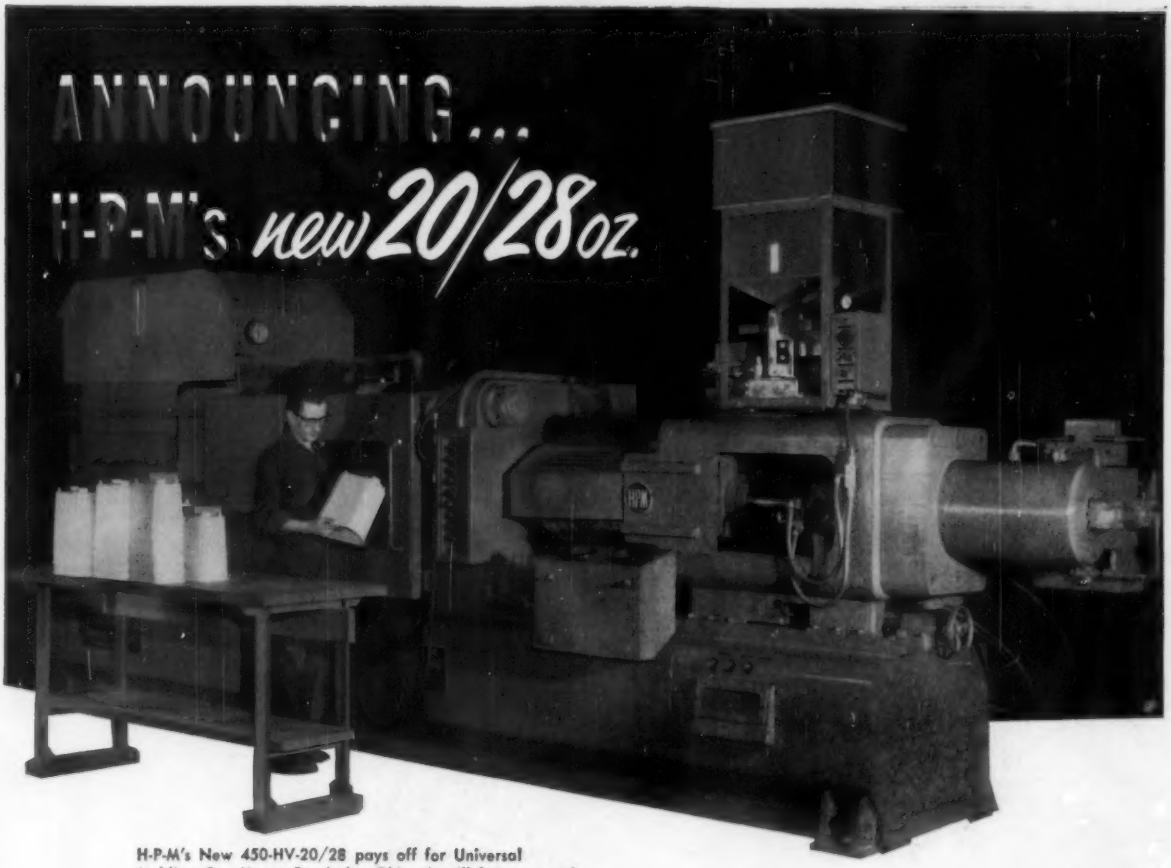


You can't transplant a human heart—yet! But you CAN put a New Heart in your old injection machine with an IMS Extra Capacity Replacement Heating Cylinder! This is a fact proven in over 800 installations on **WATSON-STILLMAN, HPM, REED-PRENTICE, FELLOWS, STOKES,** and many other makes of presses. Some machines just naturally lag behind others, but **not when equipped with IMS Uniform Design Replacement Cylinders!** Yes, your old press can have a **new heart**—it can stay in the running regardless of its make!

PLAN NOW TO INSTALL AN IMS LONG-LIFE REPLACEMENT CHAMBER ON YOUR OLDER INJECTION PRESSES! Don't wait for a costly breakdown. IMS Cylinders often double your output. They reduce degrading by using lower molding heats, and cut maintenance costs too. The only heating cylinders designed for successful use of 40 watt per sq. in. heater bands!

Older injection machines are NOT like old soldiers—they just don't fade away! Many a reconditioned press, equipped with a NEW IMS EXTRA CAPACITY REPLACEMENT CYLINDER will equal or exceed performance of COSTLY new machines. If you have heart trouble you go to a specialist. It's no use running up doctor bills repairing old style cylinders. If your press is just limping along, better call in IMS today, let us engineer a "new heart" for your lagging machines! It's a sure way to keep up your press capacity and successfully meet the competition of modern injection machines!

IMS
INJECTION MOLDERS SUPPLY CO.
3514 LEE ROAD • CLEVELAND 20, OHIO
WYoming 1-1424



H-P-M's New 450-HV-20/28 pays off for Universal Molding Co., Upper Sandusky, Ohio. It will for you, too!

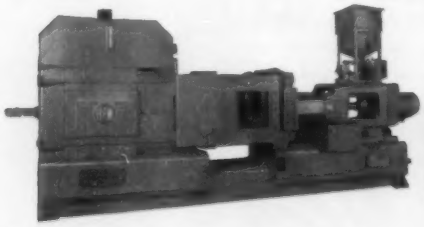
The Injection Machine Built to Your Specs!

Here's a machine that's received around-the-clock punishment for months in the plant of a busy custom molder and withstood every test. The new H-P-M 450-HV-20/28 has really proven itself in the field! It's fast, has an exceptionally high plasticizing rate and maintenance has been practically nil. Here are a few of the reasons why: It has a completely new hydraulic system; independent clamp and injection circuits; full 75 horsepower system; a separate pilot pump system which assures smooth valve shifting; accurate weigh feeder with 200 lb. hopper.

SPECIFICATIONS

Material Injected Per Cycle (Oz.)	20-28
Material Injected (Cu. In. Per Min.)	1530
Plasticizing Capacity (Lbs. Per Hr.)	200
Mold Clamp Capacity (Tons-Max.)	450
Platen Size (In.)	36x42
Daylight Opening (Max.) Without Ram Spacer (In.)	40
Clamp Travel (Max.) (In.)	25
Motor Horsepower	75
Dry Cycle (Shots Per Hr.)	400

NOTE: All injection capacities specified above are for general purpose polystyrene.

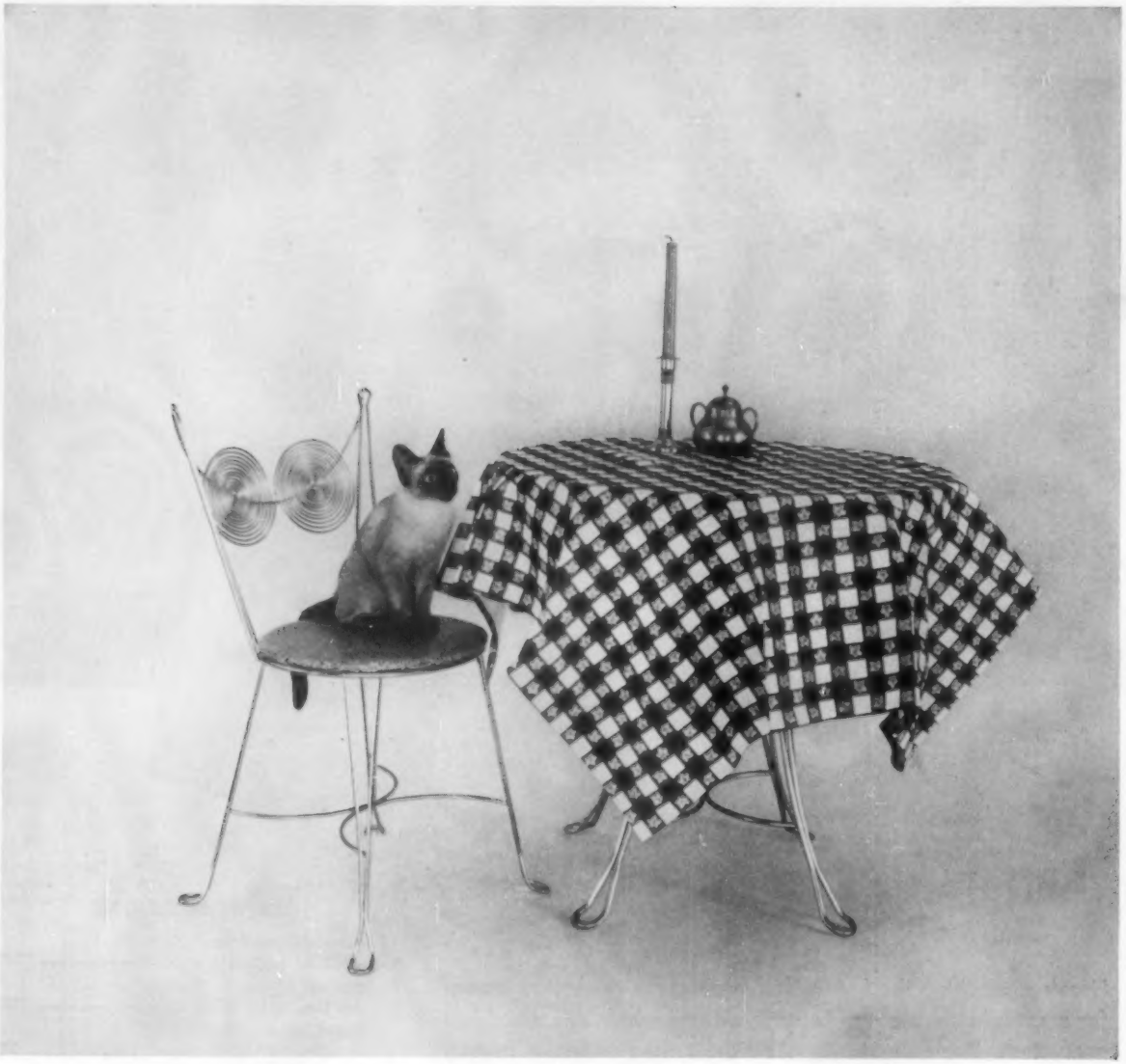


This new machine will mean bigger profits for any molding plant. For more complete information, write for Bulletin 5720, today!

HPM

THE HYDRAULIC PRESS MFG. CO.
Mount Gilead, Ohio, U.S.A.
A DIVISION OF KOEHRING COMPANY

1877—1957



great expectations

YOU CAN COUNT on Argus to more than fulfill your expectations. Argus Mark stabilizers and Drapex plasticizers give unmatched performance. Argus products are the industry's standard.

Nothing, for instance, overcomes vinyl processing difficulties or insures high quality in calendered products like Argus Mark M. With a Mark M stabilizer system, the problem of roll plate-out is eliminated and excellent heat and light stability are gained. The end product – like the tablecloth shown above – has clear color, excellent printability, outstanding heat-sealing characteristics and resists sulphide staining.

Whatever your vinyl formulation problem, *Argus has the answer*—in line products or in our research laboratory. Write for technical bulletins and samples.

ARGUS CHEMICAL CORPORATION / New York and Cleveland

Main Office: 633 Court Street, Brooklyn 31, N. Y. Branch: Frederick Building, Cleveland 15, Ohio

Rep's.: H. M. Royal, Inc., 4814 Loma Vista Ave., Los Angeles; Philipp Bros. Chemicals, Inc., 10 High St., Boston; H. L. Blachford, Ltd., 977 Aqueduct St., Montreal.



A NEW PHENOLIC, SEMI-IMPACT MOLDING COMPOUND WITH IMPROVED WATER RESISTANCE AND DIMENSIONAL STABILITY

PLENCO 476

When exposed to water, steam, detergents and rust inhibitor environments, molded plastic parts can absorb as much as 6 to 8% weight. This causes dimensional changes of from 1.5% to 2.2%, and results in cracking or warping of parts.

Plenco's new formulation, 476, has greatly improved water resistance. After 120 hours of continuous boiling in a 3% commercial detergent water solution, Plenco 476 has a total moisture gain of less than 2%. Dimensional change less than 0.5%. An additional 240 hours of continuous exposure to boiling produced no further gain in weight or dimensional change.

SPECIFIC GRAVITY
1.38-1.40

IMPACT STRENGTH
0.35-0.39 ft. lbs. per inch of notch

TENSILE STRENGTH
6500-7500 psi.

WATER ABSORPTION GAIN
0.3-0.4% (ASTM)

DIELECTRIC STRENGTH
(S/T) 250-300 volts per mil

POWER FACTOR
0.04-0.06 at 1000 KC.

HEAT RESISTANCE
Excellent to 325°F. over long exposure

PLASTICITY
Soft to hard

PERFORMABILITY
Can be tableted with automatic equipment

Applications of Plenco 476 include such items as water pump impellers, blowers, vaporizers, humidifiers, agitators, dishwasher and washing machine components, etc.

PLENCO PHENOLICS
FOR BETTER PLASTIC PRODUCTS

PLASTICS ENGINEERING COMPANY
Sheboygan, Wisconsin

Serving the plastics industry in the manufacture of high grade phenolic molding compounds, industrial resins and coating resins.

hi-fax®

HERCULES ETHYLENE POLYMER

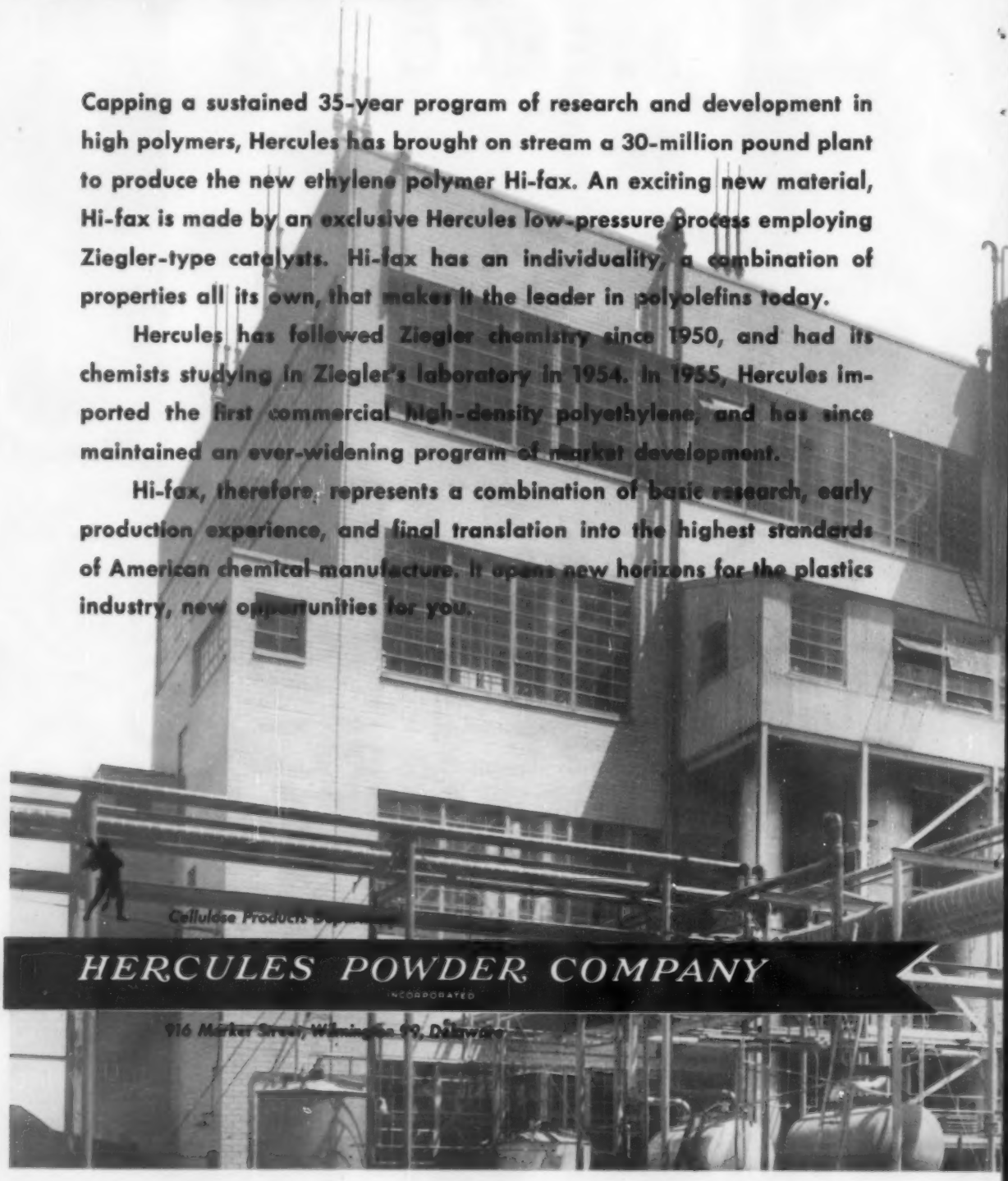
—A NEW ERA

America's First

Capping a sustained 35-year program of research and development in high polymers, Hercules has brought on stream a 30-million pound plant to produce the new ethylene polymer Hi-fax. An exciting new material, Hi-fax is made by an exclusive Hercules low-pressure process employing Ziegler-type catalysts. Hi-fax has an individuality, a combination of properties all its own, that makes it the leader in polyolefins today.

Hercules has followed Ziegler chemistry since 1950, and had its chemists studying in Ziegler's laboratory in 1954. In 1955, Hercules imported the first commercial high-density polyethylene, and has since maintained an ever-widening program of market development.

Hi-fax, therefore, represents a combination of basic research, early production experience, and final translation into the highest standards of American chemical manufacture. It opens new horizons for the plastics industry, new opportunities for you.



Cellulose Products Department

HERCULES POWDER COMPANY

INCORPORATED

916 Market Street, Wilmington 99, Delaware

manufacture of high grade phenolic molding compounds, industrial resins and coating resins.

IN PLASTICS CHEMISTRY

Ziegler Polyethylene Plant

The Significance to You of Hercules Hi-fax

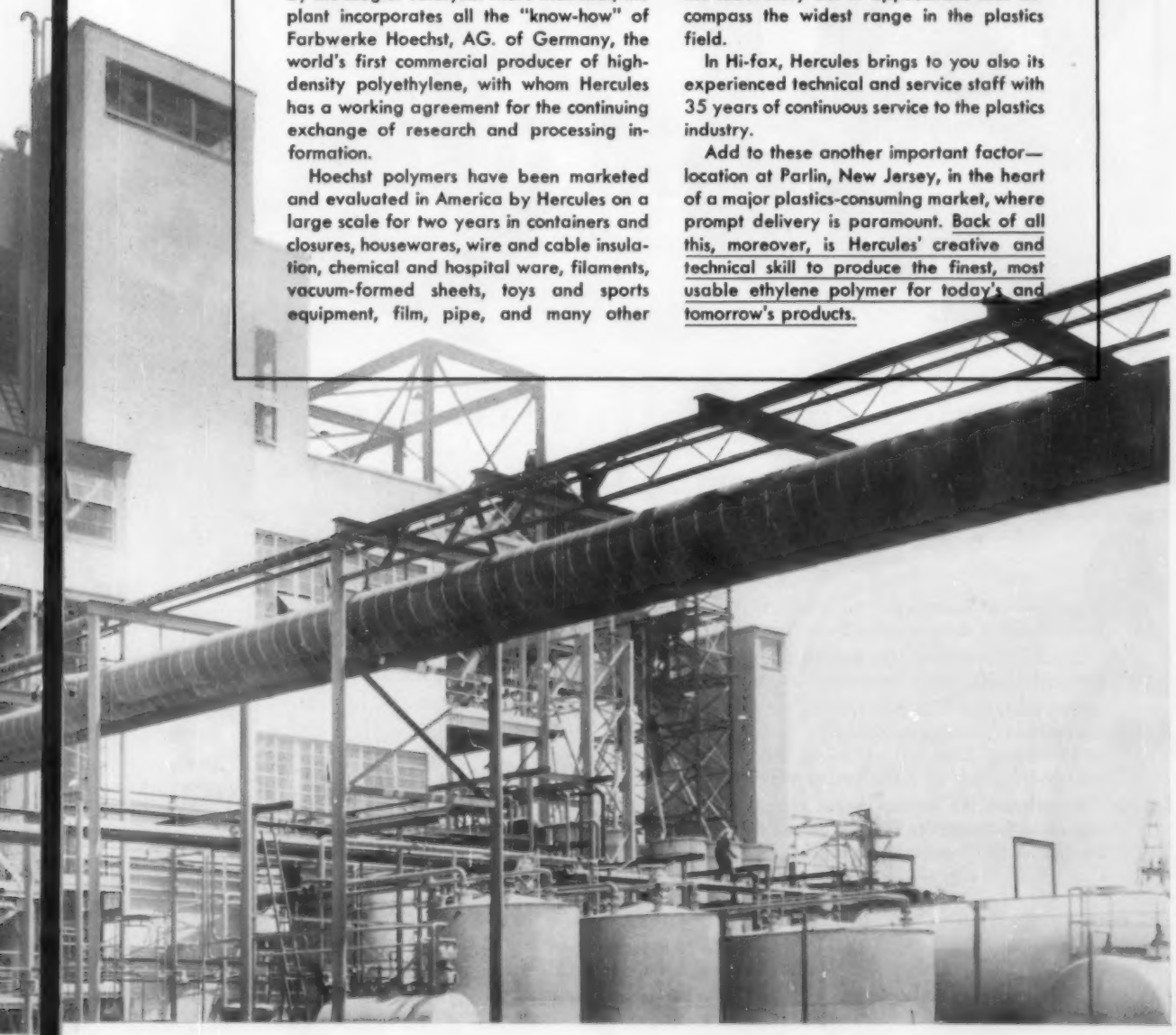
The new Hercules Hi-fax plant makes available for the first time in America a commercial plant producing proved polyethylene by the Ziegler catalysis. More than that, the plant incorporates all the "know-how" of Farbwerke Hoechst, AG. of Germany, the world's first commercial producer of high-density polyethylene, with whom Hercules has a working agreement for the continuing exchange of research and processing information.

Hoechst polymers have been marketed and evaluated in America by Hercules on a large scale for two years in containers and closures, housewares, wire and cable insulation, chemical and hospital ware, filaments, vacuum-formed sheets, toys and sports equipment, film, pipe, and many other applications.

This means that Hi-fax comes to you completely proved and established not only in the laboratory but in applications that encompass the widest range in the plastics field.

In Hi-fax, Hercules brings to you also its experienced technical and service staff with 35 years of continuous service to the plastics industry.

Add to these another important factor—location at Parlin, New Jersey, in the heart of a major plastics-consuming market, where prompt delivery is paramount. Back of all this, moreover, is Hercules' creative and technical skill to produce the finest, most usable ethylene polymer for today's and tomorrow's products.



BENZOFLEX®

PLASTICIZERS





...for added strength ...greater uniformity in vinyl foam

Vinyl foam processors are obtaining greater tensile strength, more uniform density with Benzoflex plasticizers.

Benzoflex 9-88 and 2-45 furnish highly desirable physical properties with lower processing temperatures.

Low cost, too. The Benzoflexes, a series of eight benzoate esters from Tennessee, contribute many unique advantages to processing floor tile, sheeting, vinyl foam, extrusions, plastisols, adhesives, waxes and polishes, and other products.

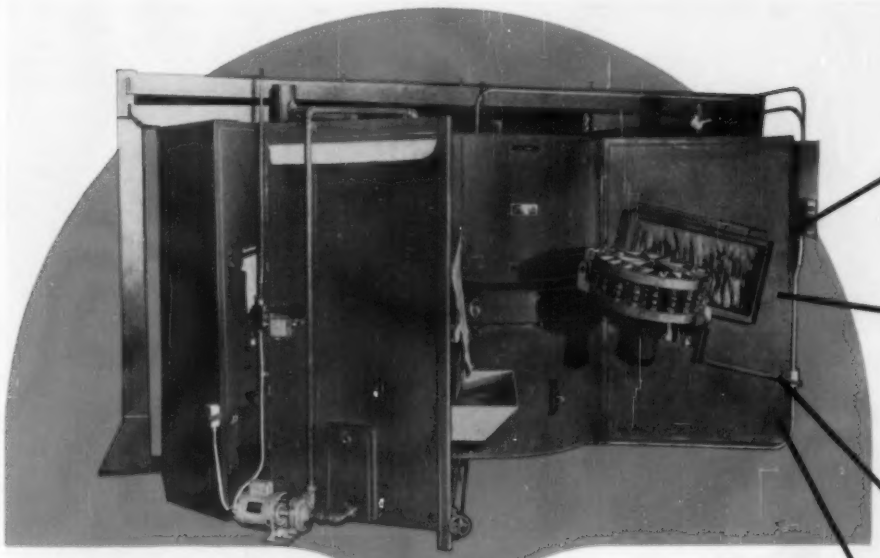
Investigate the money-saving benefits of Benzoflex. For experimental samples and technical data, write Tennessee Products and Chemical Corporation, Nashville 3, Tennessee.

TENNESSEE PRODUCTS & CHEMICAL *Corporation*

NASHVILLE, TENNESSEE

A DIVISION OF THE CHEMICAL, PAINT AND METALLURGICAL DEPARTMENT OF MERRITT-CHAPMAN AND SCOTT CORPORATION.

Finer plastics begin with **BENZOFLEX®** *plasticizers from Tennessee*











MOLDING MAGIC!

MOLD UP TO 1620 BIG PROFIT ITEMS PER HOUR . . . LIKE MAGIC

PRESTO . . . PRODUCTION and PROFITS!

Yes, it seems like magic the way this machine converts raw material into finished goods, in one continuous operation. With only one man at the controls, polyvinyl chloride plastisols are automatically dispensed and rotationally molded to shape, completely controlled by the automatic features of the machine. The operator need not be a technician, because all the plastisols are scientifically prepared, using all the technological advances made by the nation's foremost companies. Now, any hollow article can be molded from polyvinyl chloride plastisols, thus creating countless new product possibilities. With a high hourly production and a low hourly cost, it naturally follows that units produced on this machine are BIG PROFIT items.

LET US SHOW YOU HOW TO DO IT!

We want to demonstrate our "magic" to you. Visit our plant and let us mold YOUR PRODUCTS, right before YOUR EYES . . . like "magic".

Write or call for detailed data or an appointment.

NOW . . . even BIGGER!

Machines are now available with a 15", 25" and 75" molding area, able to mold items *eight times larger* than previously thought possible. Items such as the unicorn, shown here. Imagine, it's automatically molded, in one operation!



THE AKRON PRESFORM MOLD CO.

Phone WA 8-2105

2044 Main Street, Cuyahoga Falls, Ohio

FORMS	MOLDS	DIES	MACHINERY
LATEX DIPPING	STEEL AND ALUMINUM	PLASTIC INJECTION	SPECIAL AUTOMATIC

FORMACOLOR*

THE SUPERIOR COLOR CONCENTRATE FOR INJECTION MOLDING









It's a word synonymous with success in the field of color as a stimulus to consumer sales! It's FORMACOLOR! Whether you make brushes or bottles or any other plastic product, FORMACOLOR provides the eye-appeal that moves them off the shelf.

That pellet of FORMACOLOR going into the injection molding machine contains all the approved pigments required to achieve a rich and uniform finished color. Made to be diluted at a ratio of **four to one,** it costs no more than a few pennies a pound.

Experts in the plastics industry just naturally turn to Westchester Plastics, Inc., experts in the world of color. We are a service organization ready to supply thousands of specially matched colors in polyethylene and most other thermoplastic materials. Advise us of the resin you plan to use and the color you want. We will send you a sample for evaluation by your staff.



remember! the color makes the SALE!

WESTCHESTER PLASTICS, Inc.

326 WAVERLY AVENUE, MAMARONECK, N. Y. • Mamaroneck 9-5980

Custom Compounders of Polyethylene Molding Powder and other Thermoplastic Materials

Manufacturers and Developers of Unicolor and Formacolor

Plithene, Formacolor, Unicolor® T.M. Reg. U.S. Pat. Off.

from Ciba Research...

2 important NEW EPOXY DEVELOPMENTS bring greater range and versatility than ever to formulating design.

ARALDITE® 6005

is the newest addition to CIBA's family of basic epoxy resins—already the widest range available. Characteristics and special features of Araldite 6005 are shown below.

ARALDITE RD-1

is CIBA's Butyl Glycidyl Ether, and is your means of adapting the viscosities of Araldite Epoxies to fit special needs. (RD means "Reactive Diluent".) Typical features are shown below.

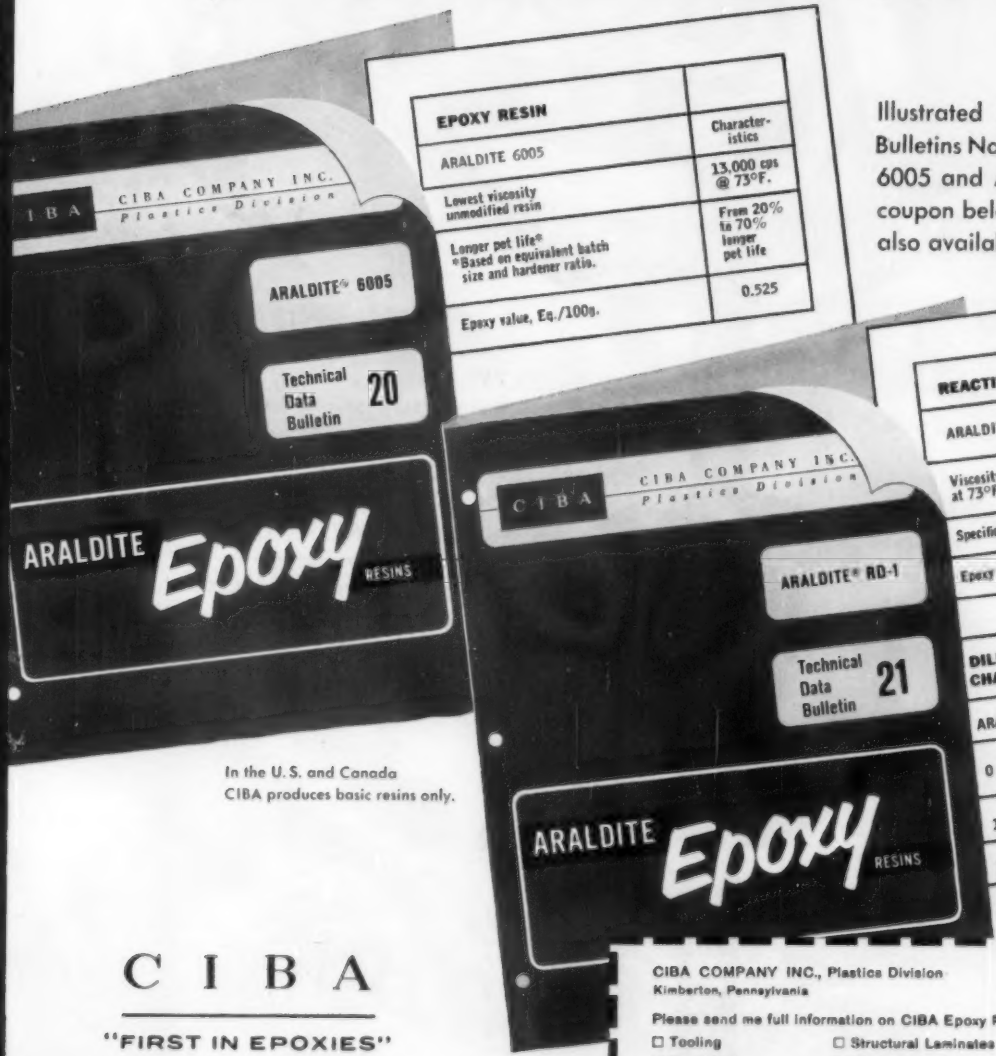
EPOXY RESIN	Characteristics
ARALDITE 6005	
Lowest viscosity unmodified resin	13,000 cps @ 73°F.
Longer pot life* *Based on equivalent batch size and hardener ratio.	From 20% to 70% longer pot life
Epoxy value, Eq./100g.	0.525

Illustrated are CIBA's new Technical Bulletins No. 20 and No. 21 on Araldite 6005 and Araldite RD-1. Send in the coupon below for your copies. Sample also available on request.

REACTIVE DILUENT	Typical Properties
ARALDITE RD-1	
Viscosity, centipoises at 73°F.	3
Specific Gravity	0.908
Epoxy value Eq./100g.	0.7

DILUTED RESIN CHARACTERISTICS	Viscosity
ARALDITE RD-1 + ARALDITE 6005	
0 phr.*	13,000 (control)
10 phr.	1,200
20 phr.	200

*parts Araldite RD-1 per hundred parts of Araldite 6005



In the U.S. and Canada CIBA produces basic resins only.

C I B A

"FIRST IN EPOXIES"

CIBA COMPANY INC., Plastics Division
Kimberton, Pennsylvania

MP-7

Please send me full information on CIBA Epoxy Resins for

☐ Tooling ☐ Structural Laminates ☐ General
☐ Electrical ☐ Hi-Strength Adhesives ☐ Surface Coatings
☐ Plastic Body Solders

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COMPANY _____ TITLE _____

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CITY _____ STATE _____

For Plastics — go to Worbla



Manufacturers of plastics for over thirty years.

WORBLA-PLASTICS have proved their worth

So that you may see for yourself — we shall gladly provide you with samples.

WOPALOID

Celluloid in sheets, tubes and rods.

WOPALON

Cellulose Acetate in sheets, tubes and rods.

WOPALIT

Acetate powder for injection molding and extrusion.

WOPAVIN

PVC (Polyvinylchloride) in calendered and pressed sheets, tubes, rods and profiles. Compounds for injection molding and extrusion.

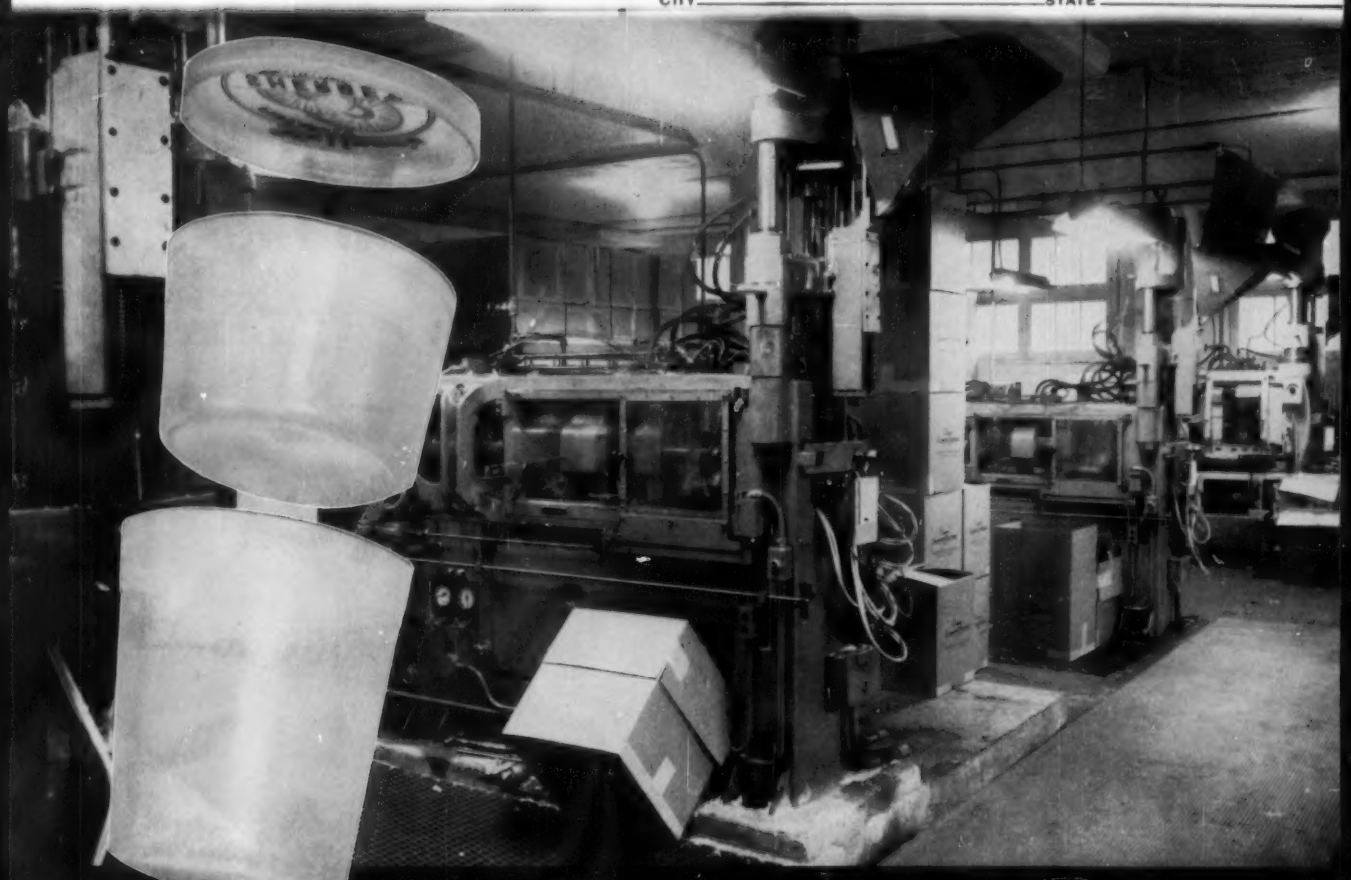
WORBLA

Nitrocellulose for lacquers and technical uses.
Bleached linters.

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ADDRESS

CITY STATE



600,000 1/2 Pint Containers per Month from High Speed 4 Ounce LESTER



THIN-WALL CONTAINER BULLETIN No. 2

The figure noted above was current when this ad was prepared. By now it may be vastly improved. That is how fast the picture is changing at Davenport Containers, Ltd., Toronto, Canada.

Their new "Alternate C" 4 Oz. Lester is a 150 ton machine powered by 78 gallons per minute of pump capacity to give a plunger filling speed of 15.6 cu. in./sec.—935 cu. in./min. *Result: the overall cycle is just a few seconds more than the mold cooling time!*

Are you interested in the constantly changing picture of high-speed automatic molding? Write for complete specifications and illustrated literature on LESTER-AUTOMATIC Injection Molding Machines.

LESTER-PHOENIX, INC.
2621-N CHURCH AVENUE • CLEVELAND 13, OHIO
Agents in principal cities throughout the world

Fabric helps shield watchful eyes on the "Texas Tower"



From this radar picket station 110 miles out in the Atlantic, land defenses will receive advance warning of approaching aircraft. The "Texas Tower" shelters its sensitive "eyes" in strange-looking balloons called "radomes," capable of withstanding the fiercest gales, yet without blocking the radar's "view." Fabricated by Firestone Tire & Rubber Co., the radomes are made of rubberized nylon actually "supported" by additional interior air pressure. And the nylon fabric, we are proud to say, was engineered for this purpose by Wellington Sears.

Fabrics for such rubberizing applications are only part of the long list provided to all kinds of industry by Wellington Sears over more than a century. Whatever your problem may be, if it involves fabric for coating—or "working" fabrics of any kind, cotton or synthetic—turn to Wellington Sears for able, experienced help.

For informative booklet, "Modern Textiles for Industry," write Dept. K-7.

Wellington Sears

FIRST In Fabrics For Industry

For Coated Materials, High and Low Pressure Laminates and Other Reinforced Plastic Products

WEST POINT TEXTILES

Wellington Sears Co., 65 Worth St., New York 13, N. Y. • Atlanta • Boston • Chicago • Dallas • Detroit • Los Angeles • Philadelphia • San Francisco • St. Louis

CAMERON

Slitters and Roll Winders

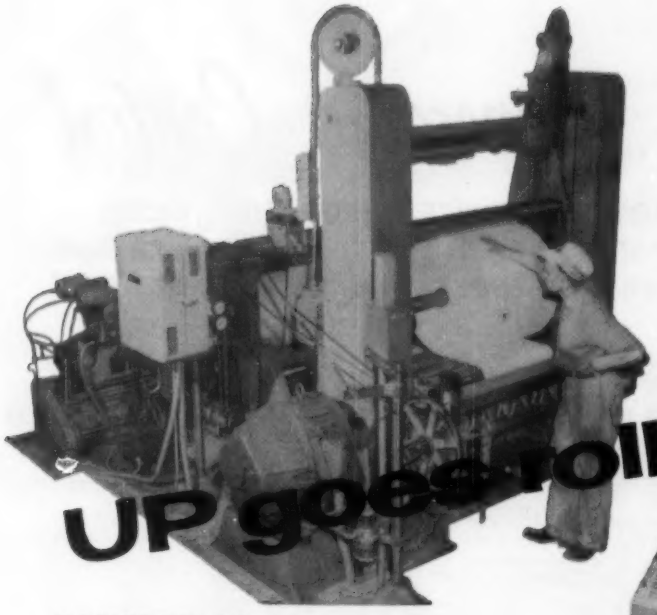
Custom-engineered by Cameron specialists

. . . to meet all production requirements

. . . to produce rewound rolls of highest quality

. . . to assure trouble-free feeding in subsequent roll finishing, printing and converting operations

. . . to increase the sales appeal of roll-wound products made for end use.



UP goes roll quality!

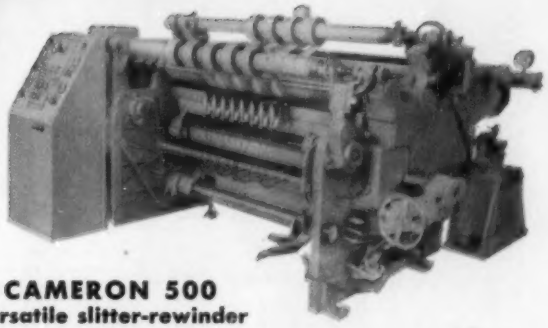
CAMERON 10
heavy duty slitter-rewinder

. . . score-cut or shear-cut slitting.

. . . speeds up to 2000 fpm*; widths 42" and 82"; rewind diameter to 40" maximum.

. . . surface rewind, with self-aligning riding roll to compensate for off-caliper stock.

. . . versatile handling of waxed, gummed, or coated paper or paperboard, textiles and rubber.



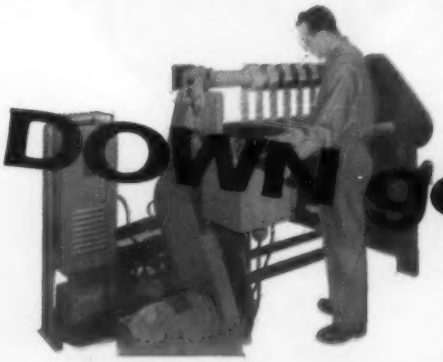
CAMERON 500
versatile slitter-rewinder

. . . quick changeover from score-cut to shear-cut or razor-cut slitting.

. . . speeds up to 2000 fpm*, widths to 62"; rewind diameter to 20" maximum.

. . . surface and center rewind, differential type, with air-loaded core friction.

. . . for plastic films, foils, papers, textiles and laminated materials.



DOWN go your costs!

CAMERON 550
low-cost slitter-rewinder

. . . score-cut, shear-cut, burst-cut or draw-cut razor slitting.

. . . speeds up to 500 fpm*; widths to 62"; rewind diameter to 15" maximum.

. . . center rewind, differential type, with air-loaded core friction.

. . . for plastic film, foils, papers, laminates and other materials.

*Speed is dependent upon machine width, the number of cuts, and characteristics of material.

A SOUND INVESTMENT in slitting and roll winding equipment will pay three-fold dividends:

. . . it will attract profitable new business by producing rewound rolls that meet the highest standards of quality.

. . . it will cut roll production costs.

. . . it will protect profits throughout the depreciation period by providing the most advanced design and operating features available today.

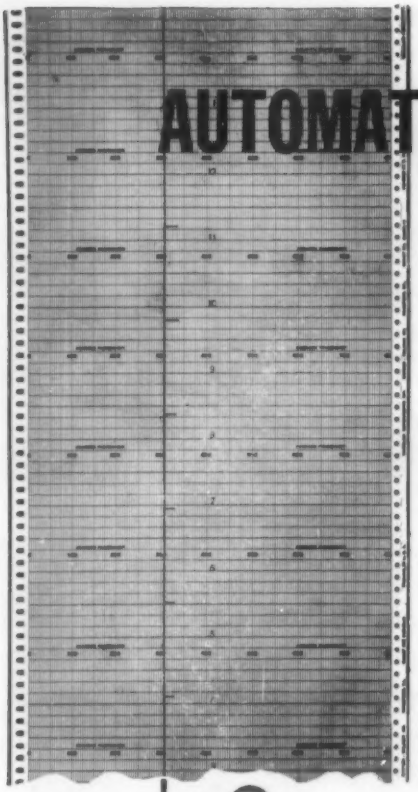
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BUILT BY CAMERON'S team of specialists

AA-335



AUTOMATIC *Temperature Control*

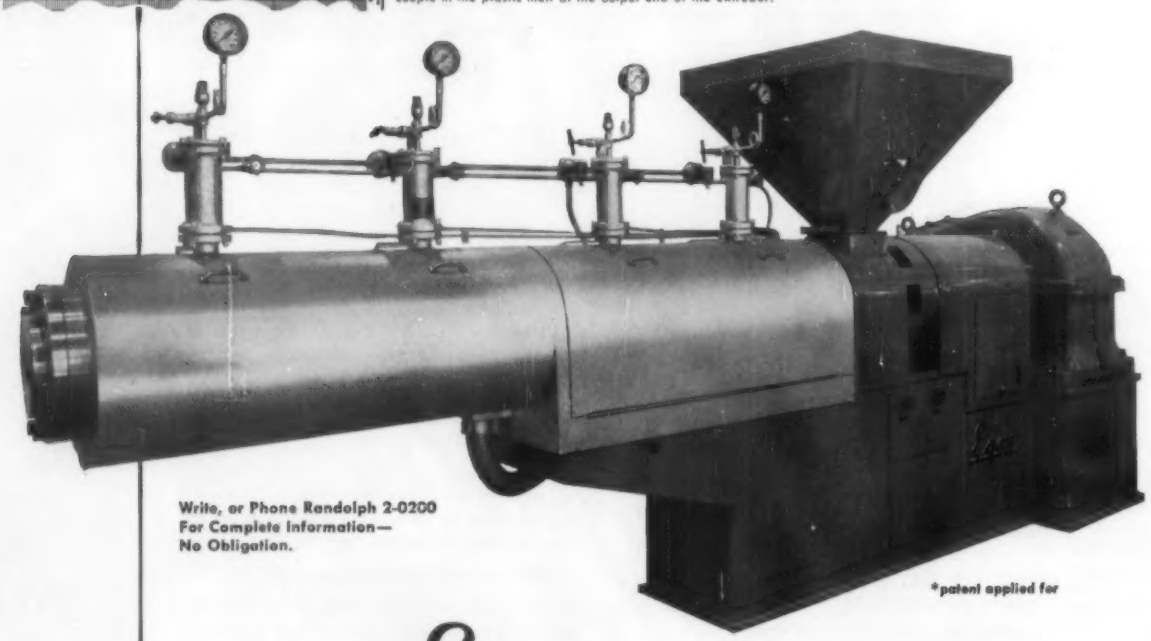
CLOSE TOLERANCE EXTRUSIONS . . . EASIER . . . FASTER . . . WITH THE EGAN EXTRUDER AND "WILLERT TEMPERATURE CONTROL SYSTEM"*

This revolutionary Egan combination automatically puts an end to the problems of heat control and quick cooling in the extruder cylinder . . . Simply pre-set the temperature and the "Willert Temperature Control System" takes over, providing completely automatic instrumentation.

NO MOVING PARTS
NO PUMPS, BLOWERS, COMPRESSORS
NO MANUALLY OPERATED VALVES OR SWITCHES

Available in full range of extruder sizes—2" through 8"

The strip chart reproduced at left shows actual material temperatures recorded during a typical day-long production run. Readings were obtained by inserting a thermocouple in the plastic melt at the output end of the extruder.



Write, or Phone Randolph 2-0200
For Complete Information—
No Obligation.

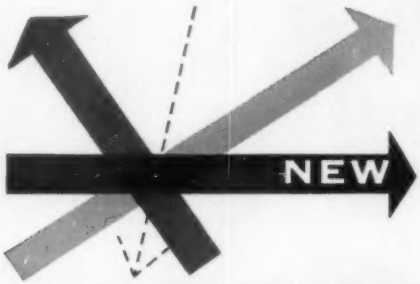
*patent applied for

FRANK W. *Egan* AND COMPANY
SOMERVILLE, NEW JERSEY

Manufacturers of plastics processing equipment

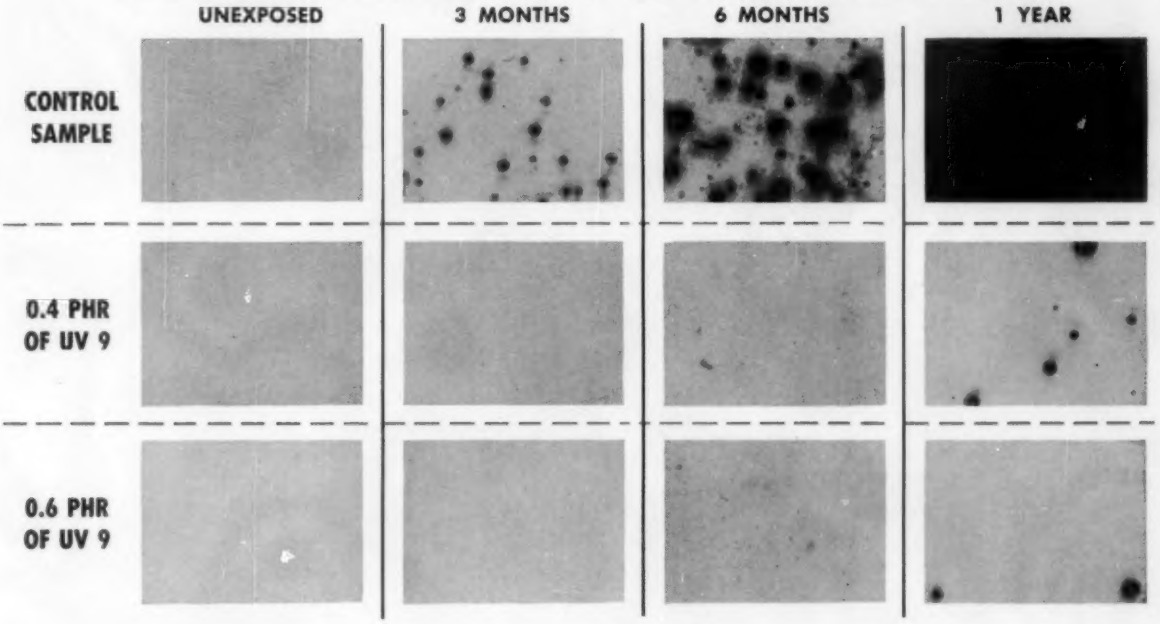
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REPRESENTATIVES: MEXICO, D.F.—M.H. GOTTFRIED, AVENIDA 16 DE SEPTIEMBRE, NO. 10. JAPAN—CHUGAI BOYEKI CO., TOKYO. LICENSEE: GREAT BRITAIN — BONE BROS. LTD., WEMBLEY, MIDDLESEX.



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PVC EXPOSED TO FLORIDA WEATHER



RESIN FORMULA				
PVC	100 PARTS	Ba-Cd LAURATE	2 PARTS
DOP	50 PARTS	ARYL PHOSPHITE	1 PART

POLYVINYL CHLORIDE

"goes outdoors" protected by Cyanamid's UV 9 absorber*

Incorporation of a small percentage of Cyanamid's UV 9 Absorber to polyvinyl chloride provides striking protection against discoloration and degradation normally caused by outdoor exposure. The clear, control sample deteriorated completely while samples containing UV 9 showed little degradation. Because stabilized plastics still look and act like new where unstabilized plastics fail, PVC's use in playthings, garden furniture, awnings, greenhouses and signs is more promising than ever.

UV 9 added to PVC and polyester resins, methacrylate and styrene polymers converts destructive ultraviolet radiation to harmless energy. Because stable and inert UV 9 is unaffected by absorption process, it provides undiminished protection to the finished product. Cyanamid's UV 9 is effective in protecting clear or pigmented plastic films or sheets, and screens out destructive ultraviolet rays that are harmful to the materials they cover.

Much practical information on properties and applications is contained in the Cyanamid booklet, *UV 9 Absorber*. Samples are also available on request.

*Trademark



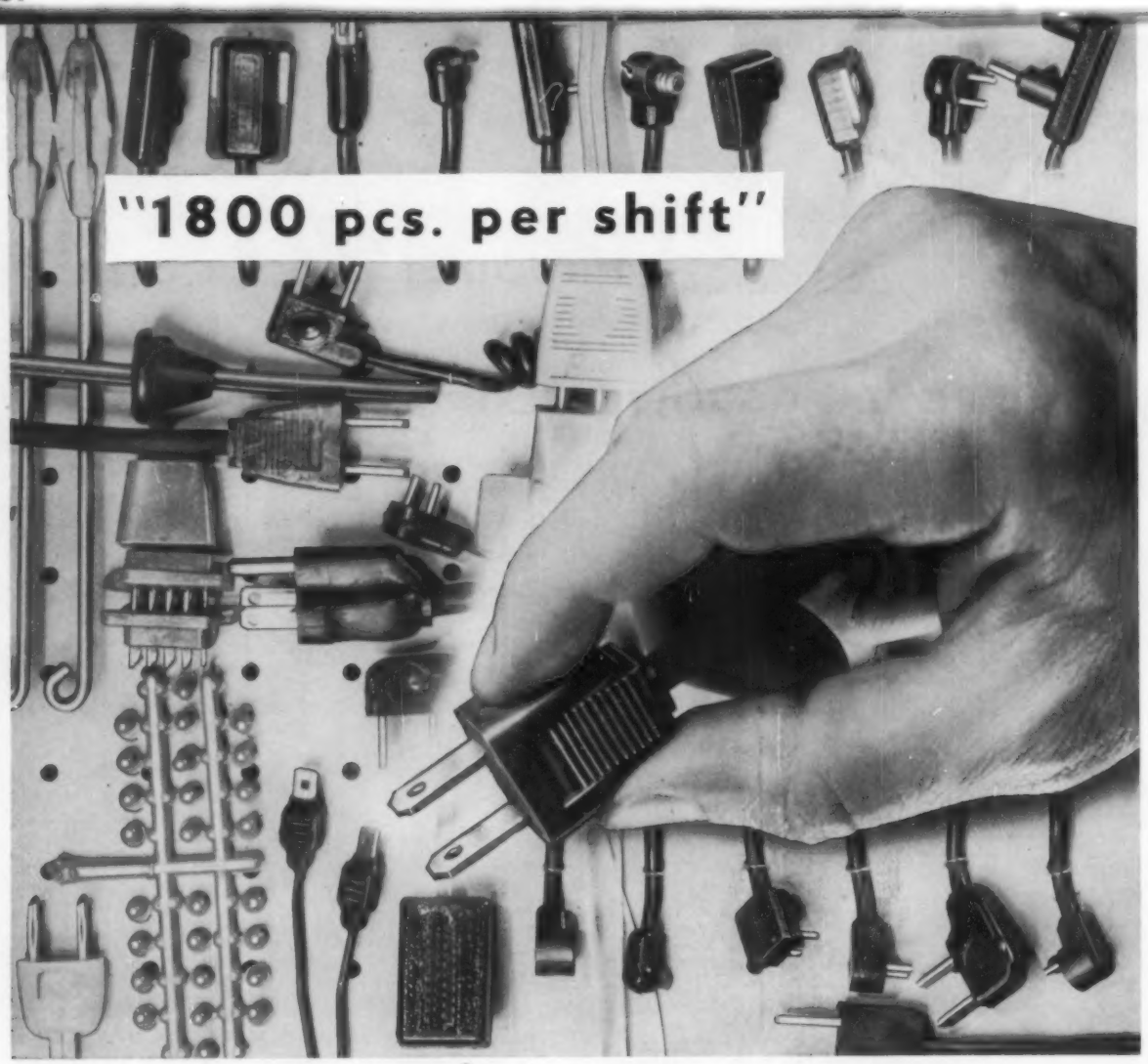
CYANAMID

AMERICAN CYANAMID COMPANY
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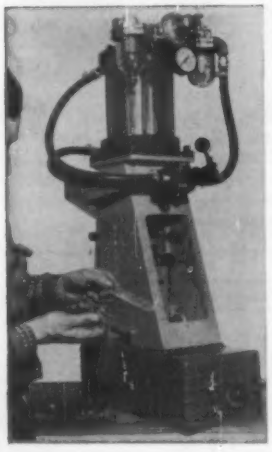
Please send me
☐ Bulletin on UV 9 Absorber
☐ Sample of UV 9 Absorber

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In Canada: North American Cyanamid Limited, Toronto and Montreal



MINI-JECTOR® solves plastic injection molding around metal inserts for major producers . . . at *lower cost!*



Model 45 "Wasp" (air)



Model 50 "Wasp" (Hydraulic)

Famous for plastic injection molding around metal inserts (encapsulating). Eliminate costly "big press" tooling. Small, compact, easy to operate. Low initial cost. Air or hydraulic power, lever or push-button controls.

"Saved thousands in tooling!", say MINI-JECTOR users. Avoid "big press" high-per-piece tooling expense where not required. (Molds for MINI-JECTOR as low as $29.50.) Develop and produce *more variety* of perfect parts at *major savings*. (Simplicity and flexibility save untold skilled manhours.) Make *more profits*—even on *short* runs. (Thousands of pieces produced *quicker*—no "big press" tooling delays.) MINI-JECTOR versatility produces practically *all varieties* of small injection molded items, 1/3 oz. to 1 oz., in all thermoplastic materials, including Nylon. (From precision "miniatures"—to full, single-cavity-size items; "insert" molding, investment casting "patterns," etc.)

Bring Your Problems to Newbury! Our pilot plant can help you select the MINI-JECTOR machine suitable for the economical development and production of your small plastic products (up to 1 oz.).

Send for FREE Catalog . . . complete, fully illustrated. Detailed information and prices on entire MINI-JECTOR line. Learn how thousands of items are developed and produced on MINI-JECTOR *faster, at lower cost* than previous methods.



NEWBURY INDUSTRIES, Inc.
Box 383, Newbury, Ohio

GERING—first choice for quality products at definite savings



Ready measured for one-step in-plant blending . . . without error!

DRYCOL

Thoroughly Compounded DRY COLORANT for All Thermoplastics

Take a real short-cut to savings with DRYCOL—the one and only dry coloring agent thoroughly formulated for specific end-color use!

Every pack of prime quality DRYCOL comes to you pre-weighed for easy, exact blending with either 50 or 100 pound quantities of any plastic. With no batches to measure, there's never any chance for error, never any spoilage hazards.

Best of all, DRYCOL lets you have colors galore without having to store! And no top-heavy inventory of colors means you can also get the volume discounts that go with buying bulk orders of natural plastics.

Write for the full story about Gering's easy-to-work-with DRYCOL.

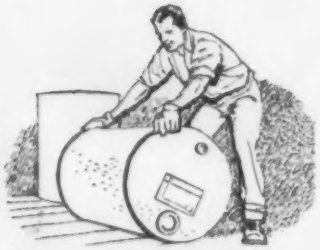
GERING

Colorants

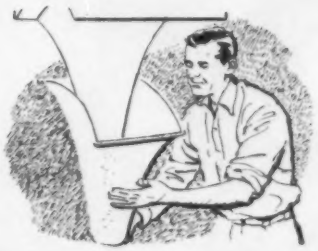
Gering Products, Inc., North 7th St. & Monroe Ave., Kenilworth, N.J. • Sales Offices: 5143 Diversey Ave., Chicago 39, Ill. • 424 Chevy Chase Rd., Mansfield, Ohio

ANNOUNCING HETRON® 33

Get top-quality moldings at lower cost with this new Durez polyester



1. You'll be pleased, we think, with this new HETRON medium-viscosity semi-rigid polyester. It's just out of the lab and in *limited* commercial production. Its name is HETRON 33.

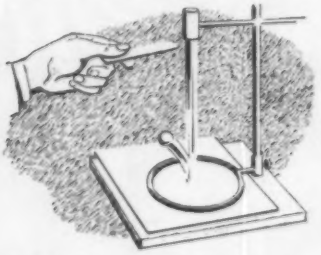


2. You can get outstandingly strong, crack-resistant laminates with HETRON 33. It's formulated especially to give you high-quality matched-die moldings. And you get them at *new low cost.*

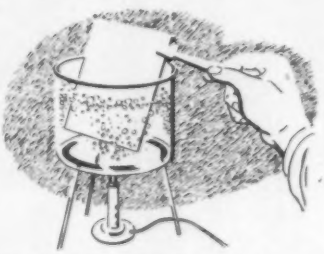
Flexural Strength, 73°F, psi	40,900
Flexural Modulus, 73°F, psi	1.6×10^6
Flexural Modulus, 180°F, psi	1.0×10^6
Tensile Strength, 73°F, psi	21,500
Tensile Modulus, 73°F, psi	1.7×10^6

TESTS MADE on 1/10" laminates containing 40% glass, 15% filler, 45% HETRON 33.

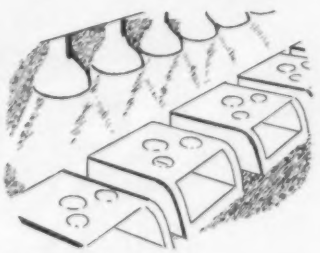
3. Imagine a semi-rigid resin with physicals like these for this type of laminate! HETRON 33 actually combines *resiliency* of a semi-rigid with *strength* of a rigid resin. And it gives you parts that *don't crack or craze.*



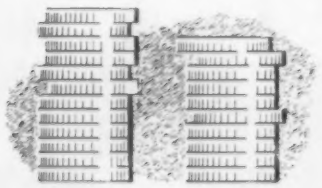
4. High reverse impact is another reason why you'll find HETRON 33 just right for parts that must stand up under rough usage. It minimizes rejects; cuts hand finishing up to 50%.



5. Wet strength is outstanding, too. Typical laminates retain 91% of flexural strength and flexural modulus after a 2-hour water boil. Water absorption after a 2-hour boil is only 0.1%.



6. Baked-on finish can be applied with excellent results to parts made with HETRON 33. Typical laminates can be baked at 350°F for 90 minutes, *several times,* without cracking or crazing.



HETRON 32A HETRON 33

7. Makes you more competitive on top-quality moldings. Because of research improvements, HETRON 33 gives you these properties *for less money!* Lower cost per pound, combined with lower gravity, saves you about 13%!

8. See for yourself how you can get superior moldings with HETRON 33—within a price range you and your customers can't afford to pass up! *Try this new resin on the toughest matched die molding job now on your presses.* For a sample and technical data, just cut out this coupon, attach to your business letterhead, and mail today.

HETRON 33 has permanent, built-in flame resistance, too—but to a somewhat lesser degree than other HETRON resins.

DUREZ® *Plastics that fit the job*

DUREZ PLASTICS DIVISION

HOOKER ELECTROCHEMICAL COMPANY

3007 Walck Road, North Tonawanda, N. Y.

HOOKER CHEMICALS PLASTICS

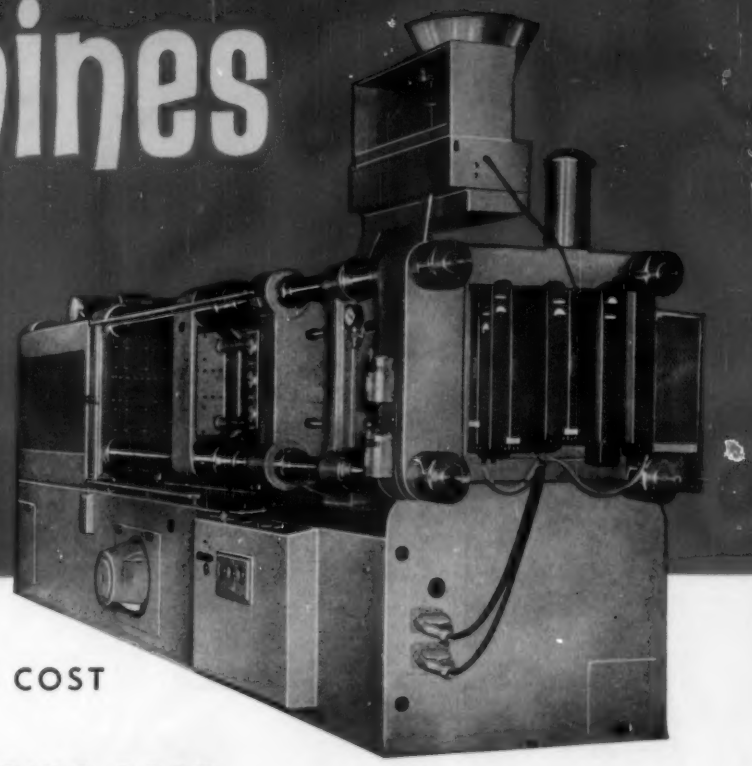
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For full information about Battenfeld machines, contact our representative at the British Plastics Exhibition, Olympia, London, July 10-20, 1957

BATTENFELD

INJECTION MOLDING

machines give you

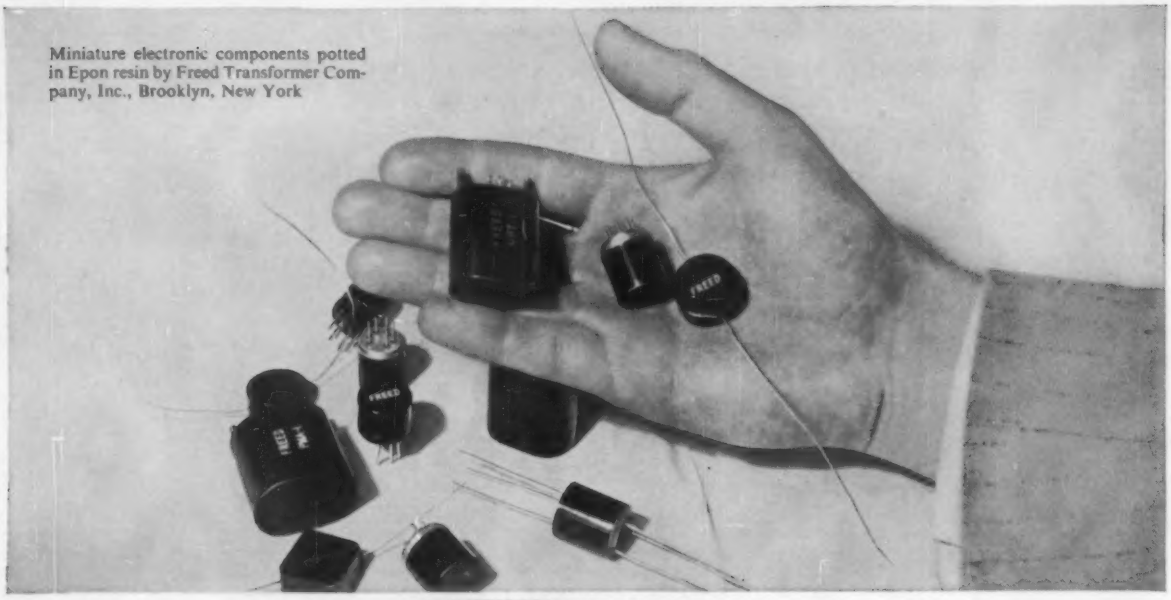


1. LOWEST INITIAL COST
2. LOWEST OPERATING COST
3. LOWEST MAINTENANCE COST

plus:

- FULLY AUTOMATIC MOLDING
- WEIGHT FEEDERS AS STANDARD EQUIPMENT
- TWO SEPARATE MOLD PROTECTION SYSTEMS

SOLD AND SERVICED BY MOLDING SYSTEMS INC. DANIELSON, CONNECTICUT



Miniature electronic components potted in Epon resin by Freed Transformer Company, Inc., Brooklyn, New York

Why EPON® RESINS for potting?

4 Good Reasons!

1. Outstanding adhesion to metal, glass, plastics
2. Excellent dimensional stability
3. High mechanical strength
4. Excellent dielectric properties

EPON RESINS are preferred for potting, laminating, sealing and encapsulating because they offer an almost ideal combination of electrical and physical properties.

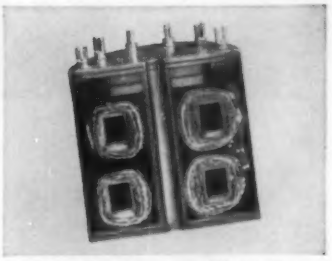
Potting and encapsulating. Epon resins have outstanding adhesive properties. They form strong bonds to metal and glass, provide airtight enclosure of delicate components and vacuum tubes. They also have excellent dimensional stability and can withstand solder bath temperatures.

Sealing. Enamels and varnishes based on Epon resins provide excellent moisture sealing plus outstanding resistance to solvents and chemicals, even at elevated temperatures.

Laminating. Epon resins, laid up with inert fibrous fillers, produce base laminates of superior dielectric properties which can be sheared, punched, drilled and bath soldered.

Adhesives. Solvent-free Epon resin formulations cure at room temperature, with contact pressure alone; form powerful bonds between glass, metal, wood or plastic.

Write for complete information on the use of Epon resins in protective enamels, tool and die materials, etched circuit laminates, transformer and motor sealing compounds.



Section of magnetic amplifier coils embedded in Epon resin by Westinghouse Electric Corporation, Pittsburgh, Pa.



Potting transformer with Epon resin at PCA Electronics, Inc., Santa Monica, Calif.

SHELL CHEMICAL CORPORATION

CHEMICAL SALES DIVISION 380 Madison Avenue, New York 17, New York

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The Plastiscope*

July 1957

News and interpretations of the news

By R. L. Van Boskirk

Section 1

Polystyrene price changes. No one was particularly surprised when Dow Chemical Co. reduced the price of general-purpose crystal polystyrene from 27½¢ to 26¢ a pound. Colored material was reduced ½¢ a lb. at the same time. Modified polystyrenes and copolymer resins were not affected by the Dow announcement, but styrene-butadiene latexes were reduced by 1½¢ a pound. The latter are used primarily for paint. Other producer announcements concerning polystyrene prices are expected to follow, but had not been made at the time this article was written. The polymer price reduction had been anticipated ever since the arrangement for reducing the price of rubber-grade monomer became known over a year ago. There has been considerable guessing about the amount of the reduction, especially since the polymer price had been reduced three cents a lb. in September 1956, in anticipation of the monomer price reduction which was scheduled for July 1, 1957. For many years there has been a price differential between styrene monomer used for rubber and that used for plastics, since the latter is more highly refined. On July 1, the rubber-grade styrene monomer will be about 12½¢ lb. and plastics grade about 16¢. Indications are that producers need about a 10¢ margin between monomer and polymer in order to make a profit. A more detailed discussion of the price change is given on page 214 of this issue.

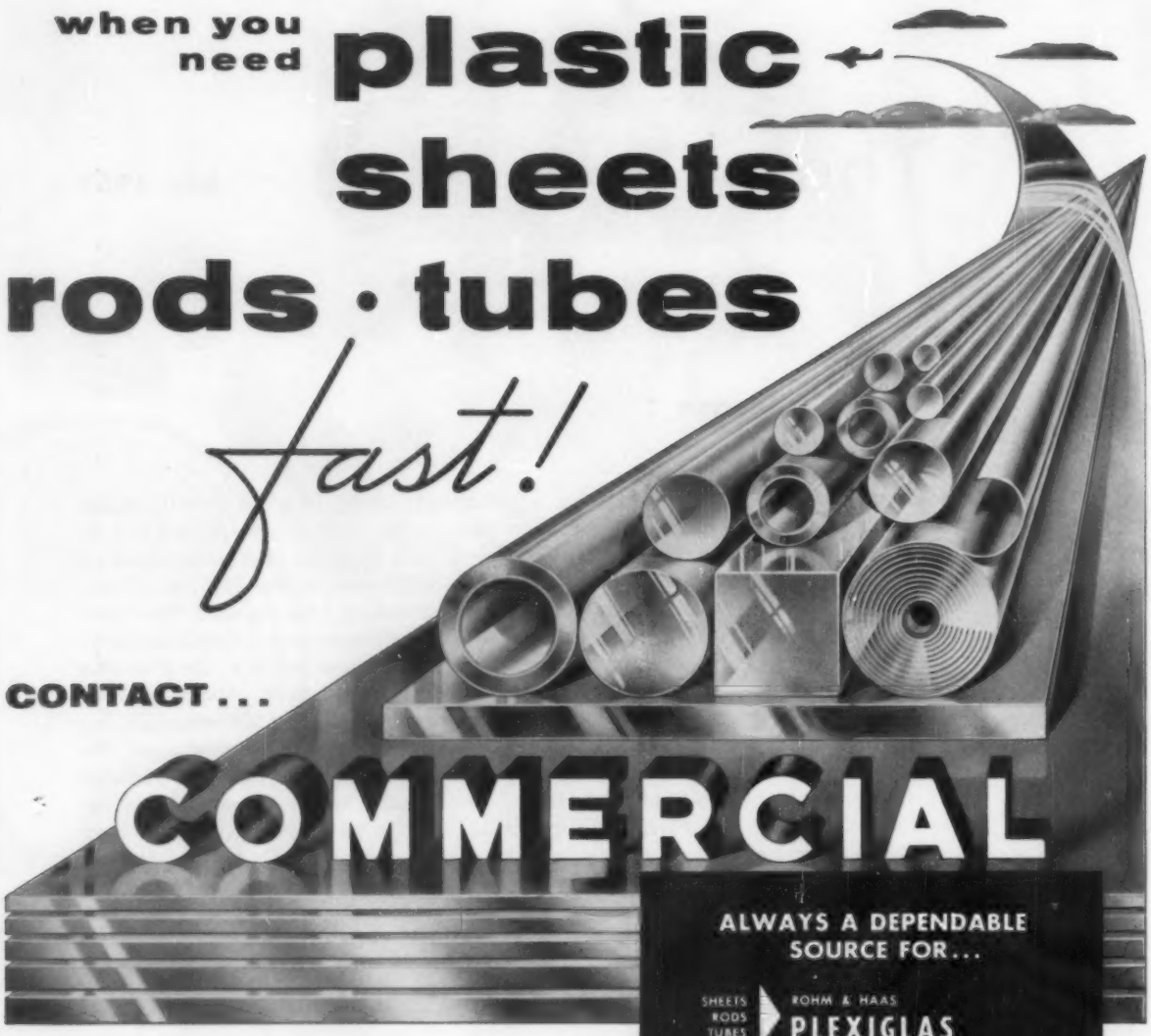
Teflon expansion program. Du Pont is expanding its facilities for Teflon production at Parkersburg, W. Va., by about one third. The company has never stated its Teflon capacity, but the trade estimates that around five million lb. were consumed in 1956. Output of Teflon 1 and 5, used for compression molding and ram or screw extrusion, will be increased by 30% by mid-1958. Construction already under way will double production of Teflon 6 and 30 by late 1957. Teflon 6 is a fine powder and 30 is an aqueous dispersion.

Substantial funds have also been appropriated for design of a plant to produce Teflon 100-X perfluorocarbon resin, an experimental product which has a melt viscosity low enough to permit extrusion in standard equipment. The term "perfluorocarbon resin" has been adopted to distinguish the new material from the Teflon tetrafluoroethylene resins, although both are true fluorocarbons with saturated structures consisting of fluorine and carbon.

The new perfluorocarbon resin shares the physical, electrical, and thermal properties of tetrafluoroethylene resins at temperatures up to 400° F. In comparison, Teflon tetrafluoroethylene may be used in continuous service up to 500° F. However, 100-X is expected to be used for applications not possible in the older Teflons because 100-X is easier to process. Du Pont is also considering the manufacture of film from 100-X and there is a suspicion in

*Reg. U.S. Pat. Off.

when you need **plastic sheets rods · tubes** *fast!*



CONTACT . . .

COMMERCIAL

HERE AT COMMERCIAL . . . This we can assure you . . . Whether you need a short rod of Phenolic Laminate or a truckload of Plexiglas sheets . . . you get the plastic you want . . . *fast* . . . in any desired size, thickness, color and quantity. COMMERCIAL is the industry's largest, most completely dependable source for plastic sheets, rods, tubes and film.

Write Dept. MP for "Sq. Ft. Converter" Chart —also New 1957 Catalog (64 pgs.) "Plastics for Industry"

COMMERCIAL
Plastics & Supply Corp.
630 Broadway, N.Y. 12, N.Y.
Phone: GRamercy 7-5000

BRANCHES: 3801 N.W. Second Ave., Miami, Fla.
119 9th St., Pittsburgh, Pa.
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ALWAYS A DEPENDABLE SOURCE FOR...

SHEETS RODS TUBES	ROHM & HAAS	PLEXIGLAS
RODS STRIPS TUBES SLABS	DU PONT	NYLON
RODS TUBES	DU PONT	LUCITE
TAPE RODS TUBES SLABS	DU PONT	TEFLON
RIGID SHEETS	BAKELITE	VINYLITE
SHEETS RODS TUBES	ST. REGIS PHENOLIC	LAMINATES
FILM SHEETS RODS TUBES	DU PONT	POLYETHYLENE
SHEETS FILM	CELANESE	ACETATE
SHEETS RODS TUBES SLUGS	DOW	POLYSTYRENE

The Plastiscope

(*Continued from* p. 41)

the trade that the material may some day be made available in a formulation for injection molding.

Current engineering studies, if successful, are expected to lead to commercial-scale shipments early in 1959. Small quantities of 100-X, priced at $19.00 a lb., are now available.

To double melamine and urea capacity. Expansion plans aimed at more than doubling its Plaskon melamine and urea production facilities at Toledo, Ohio, have been announced by Barrett Div., Allied Chemical & Dye Corp. Completion of the expansion is expected by mid-1959. This move is partly due to the growing market that has been unfolding in the melamine dinnerware field.

Barrett has also been expanding in other areas. In 1956, construction was started that is expected to result in doubling the company's polyester resin capacity and in quadrupling its capacity for producing phenolics.

Rigid products from plastisols. Plastisol compounds for the production of rigid products have been announced by Watson-Standard Co., Pittsburgh, Pa. Tradenamed Rigidsol, these compounds are low-plasticized vinyl dispersions furnished as one-package, low-viscosity, free-flowing liquids. Heating to 350 to 400° F. converts them to a tough, rigid, non-brittle elastomer. The line of Rigidsols is available in a range of hardnesses going as high as 60 on the Shore "D" Durometer scale.

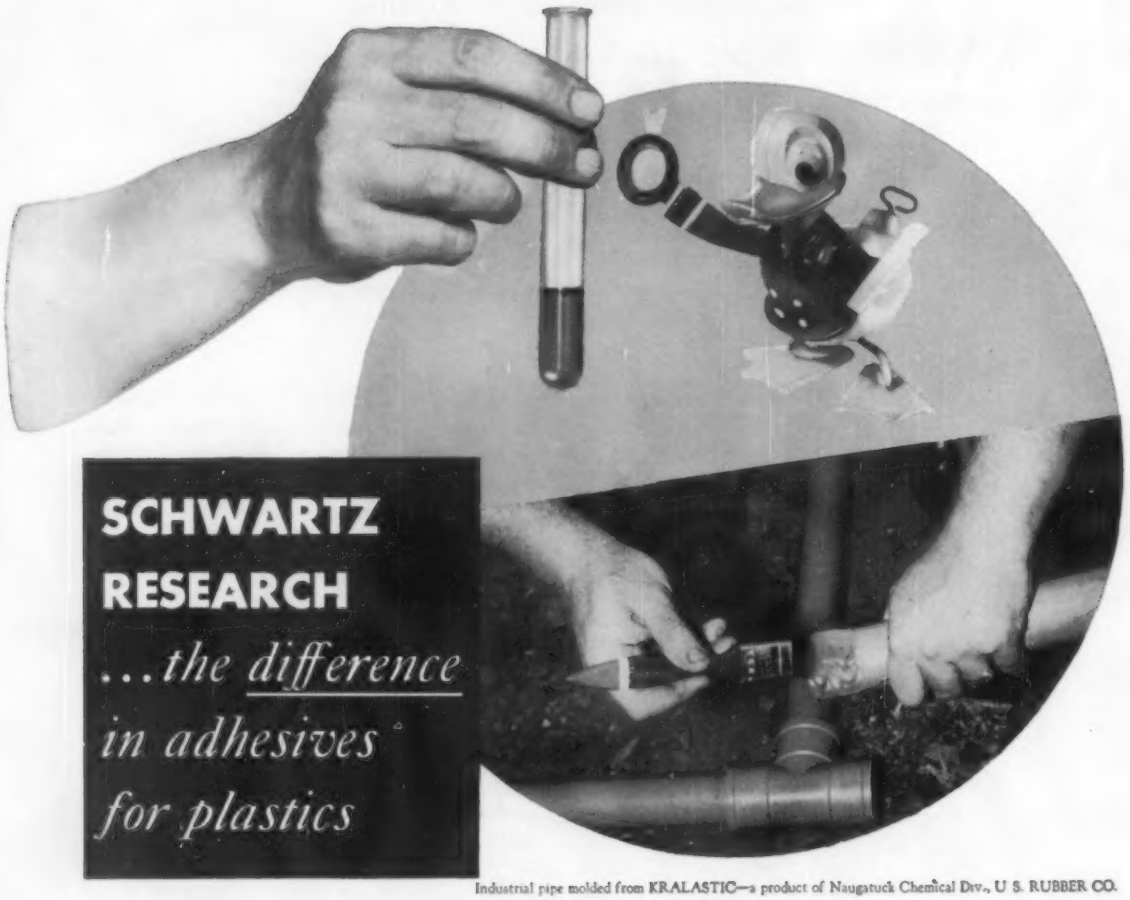
According to the company, the new plastisols maintain good viscosity stability on aging and can be used in rotational molding, slush molding, spread coating, and casting. Applications which are presently being produced with the material include anatomical models, boat bumpers, life rings, battery water jugs, toys, and advertising displays.

New styrene for impact sheet. Specifically developed for sheet extrusion, a new formulation of high-impact styrene resin has been introduced by Monsanto Chemical Co., Plastics Div., Springfield, Mass. The material, called Lustrex Hi-Test 88B, is said to extrude up to 10% faster than competitive styrenes.

In its extruded form, 88B is especially recommended by Monsanto for use in the manufacture of refrigerator door liners, either by vacuum or drape forming. It is claimed to form easily with a minimum of residual strain. Translucent milky white in its natural state, extrusion grade 88B is also available in a range of colors. An injection molding formulation of Lustrex Hi-Test 88B was introduced by Monsanto early last year. Its chief use is in the manufacture of thin wall containers.

Anti-oxidants for polyolefins. Producers of low-pressure-processed polyethylene are reported to be showing increased interest in Monsanto's Santonox as an anti-oxidant, since in many cases it helps to prevent loss of tensile properties and decreased flow when heat is applied by the processor of polyethylene resins.

Santonox is the new name for the polyethylene (both high- and low-pressure-processed) anti-oxidant formerly known as Santowhite Crystals;



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The Plastiscope

(*Continued from p.* 43)

Santowhite Crystals and Santowhite Powder, also produced by Monsanto, have long been used as rubber anti-oxidants, but only Santowhite Crystals can be used as an anti-oxidant for polyethylene. Santonox is identical to Santowhite Crystals. Monsanto made the change in nomenclature to avoid confusion in filling orders.

Santonox, which has low color and low odor, is estimated to be four times more effective at minimizing degradation than other commercially available non-staining anti-oxidants, and is claimed to be non-extractable.

The material has been accepted by the FDA for use in high-pressure polyethylene that goes into food containers; acceptance for low-pressure-processed polyethylene is anticipated in the near future. Prices are as follows: In 1-ton quantities and over, $1.55/lb.; in standard 150-lb containers in shipments up to 1 ton, $1.57; lesser quantities, $1.62.

A purified grade of Santonox designated Santonox-R is also being produced by Monsanto, but at present only in developmental quantities. This grade is said to have superior efficiency and crystallinity, and to be still lower in color and odor. When available in commercial volume, Santonox-R may sell at approximately $2.80/lb.

Structural sandwich design course. M.I.T. is offering a two-week course in design of structural sandwiches. Topics to be covered include materials for sandwiches, methods of fabrication and their effects on performance, theoretical and experimental load-bearing behavior of sandwiches, and joining and sealing techniques. In addition to M.I.T. staff members, lecturers include practicing architects, consultants, and men of industry experienced in the use of sandwich structures. Tuition is $250; the time is from July 8 through July 19.

Plastisol molds for stone. Thousands of pounds of plastisol compound are now being used for molds to produce artificial stone, an industry that has made startling progress in the last two years. This simulated stone, cast from concrete in thicknesses of about ¾ in., is used to replace 5-in. thick cut stone for building purposes, particularly as a veneer for renovating old buildings.

Dennis Chemical Co., St. Louis, Mo., supplies two different types of compounds for making molds for this process. One is its Denflex No. 9191-10, which is poured cold into a cast aluminum master mold, heated for 1½ hr. to cure and then cooled, after which it is ready for pouring of the concrete "stone." The other formulation is a hot melt compound, No. 9500, which is simply poured into the master mold after heating to 300 or 350° F.

The plastisol molds in which the stone is cast vary in size—an average is about 2 ft. sq. and 2 in. thick. Cycle time for the stone, which is usually steam-cured, is from 12 to 24 hr., which means that each stone producer must have hundreds of molds.

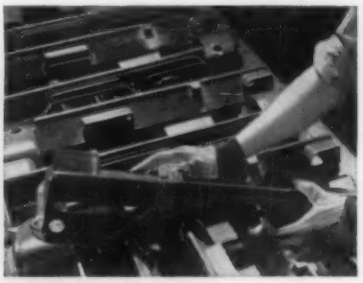
Plastics future in construction. Plastics in construction was emphasized at the last Chemical Market Research Assn. meeting in New York in a paper read by Michael Gigliotti of Monsanto Chemical Co., who said among other things: "The long range future for plastics in construction is 'long range' only because



1 This premix consists of reinforcing material, such as fiber glass or sisal, thoroughly mixed with polyester resin containing Dow Styrene.



2 The premix molding compound flows evenly to each and every section of the closed die as it is compressed under heat and pressure.



3 After a very short cycle, the finished premix molding is removed from the die. It is now ready for immediate assembly or shipment.



4 **CUTAWAY VIEW SHOWS** uniform strength in every section. There's no resin-rich area, no special reinforcing, no pre-forming.

For lower bids: premix moldings

For uniform strength: polyester resin with Dow Styrene

Many complicated parts—especially parts with varying wall thicknesses—are now made better, at lower cost, by premix molding. There are no resin-rich areas. Strength is uniformly distributed. Pre-forming is eliminated. And holes and nozzles can be molded in a part, eliminating punching and drilling operations.

Leaders of the automotive and appliance industries have proved the benefits of premix moldings for specific parts. Many innovations are now on the drawing boards.

The product shown is an example of the many now being made by premix molding using Dow Styrene. For technical assistance on Dow Styrene, write THE DOW CHEMICAL COMPANY, Midland, Michigan – Plastics Sales Department PL1886E-1.

Photographs through the courtesy of Fabricon Products, River Rouge, Michigan

YOU CAN DEPEND ON DOW

The Plastiscope

(*Continued from p. 45*)

of the inherent inertia of the construction industry . . . the engineer and designer does not understand the language of the plastics industry and vice-versa . . . plastic sandwich panels fabricated entirely of one material but with varying density of core and exterior surfaces may well be the answer to the curtain wall problem . . . in the future, sinks, bathtubs, lavatories, and water closets may be molded in modular units, including wall and floor sections; entire utility cores molded in one piece may be commonplace."

Mr. Gigliotti emphasized in particular the possibility that plastics may eliminate fasteners and joints, especially in the development of large prefabricated units. If the work in developing structural adhesives for airplanes is successful, and there are signs that it will be, we can expect a revolution in other construction methods in the next 20 years, he said. He also estimated the 1956 value of plastics and resins used in building at $142 million and the products made from these materials at about $500 million, stating that while this is only about 3⅓% of all materials used in building, it represents between 15 and 20% of the plastics industry.

Telephones now big volume. At the same meeting mentioned above, S. O. Morgan of Bell Laboratory said that eight to nine million telephone hand sets were produced in 1956, of which 25% were in color. This figure of more than two million telephones in color was twice as big as the year before. Mr. Morgan didn't mention materials used, but it is believed that the total represents more than 10 million lb. of plastics with seven or eight million in black phenolic. The colored phones are molded primarily from cellulose acetate butyrate, but other cellulosics are undergoing evaluation. Mr. Morgan also gave some interesting statistics on wire and cable, most of which is now plastic-coated. He said that Western Electric produced 100 billion ft. of cable in 1956; that only 20% of telephone cable now in use is sheathed in lead, the remainder is coated with polyethylene; that one of the most urgent needs in the communications industry today was a "cheap" plastic for underground conduit. But he didn't say how cheap is cheap.

The C.M.R.A. group elected R. E. Chaddock of Hercules as president and K. R. Parket of B. F. Goodrich Chemical Co. as president-elect.

More bisphenol for epoxies. Monsanto Chemical Co. has doubled its production capacity in St. Louis for bisphenol A, a resin intermediate used in the manufacture of epoxy resins and oil-soluble phenolic resins. Most of the increased bisphenol A demand is credited to the booming use of epoxy resins. Domestic production of these resins in 1956 totalled 30 million lb., an increase of more than 50% over the 1955 U.S. output.

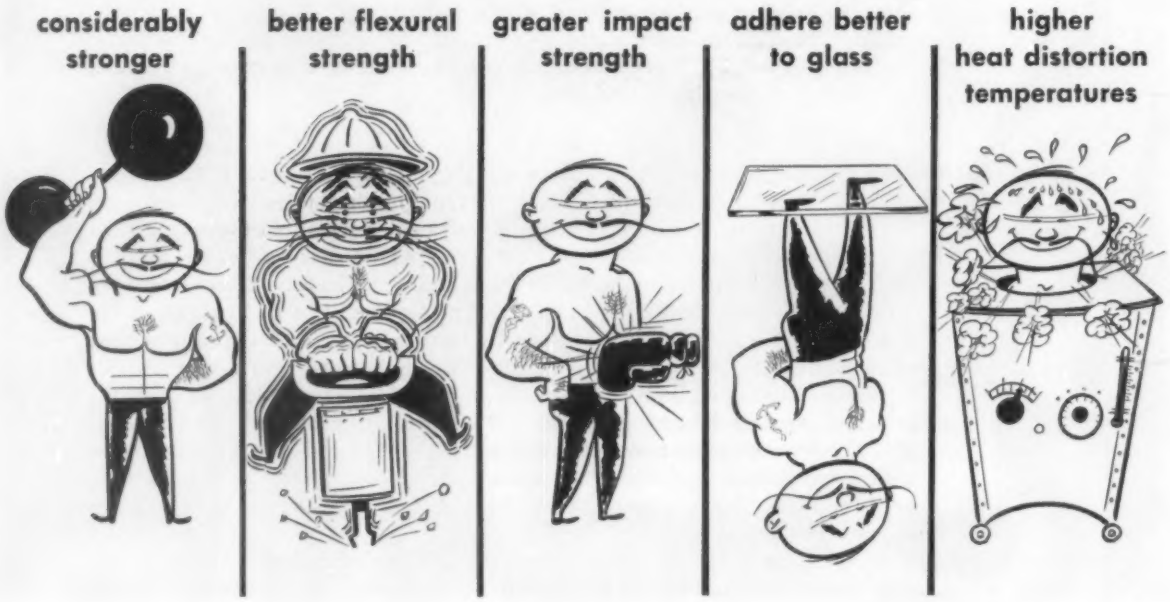
Bisphenol A is also used in the manufacture of recently developed polycarbonate resins, high-melting-point thermoplastic materials. Development work is also being carried out by Monsanto on potentially important derivatives such as hydrogenated and chlorinated bisphenol A, compounds which may find applications not only in resin manufacture, but also in adhesives, agricultural chemicals, pharmaceuticals, and plasticizers.

For additional and more detailed news see Section 2, starting on p. 214

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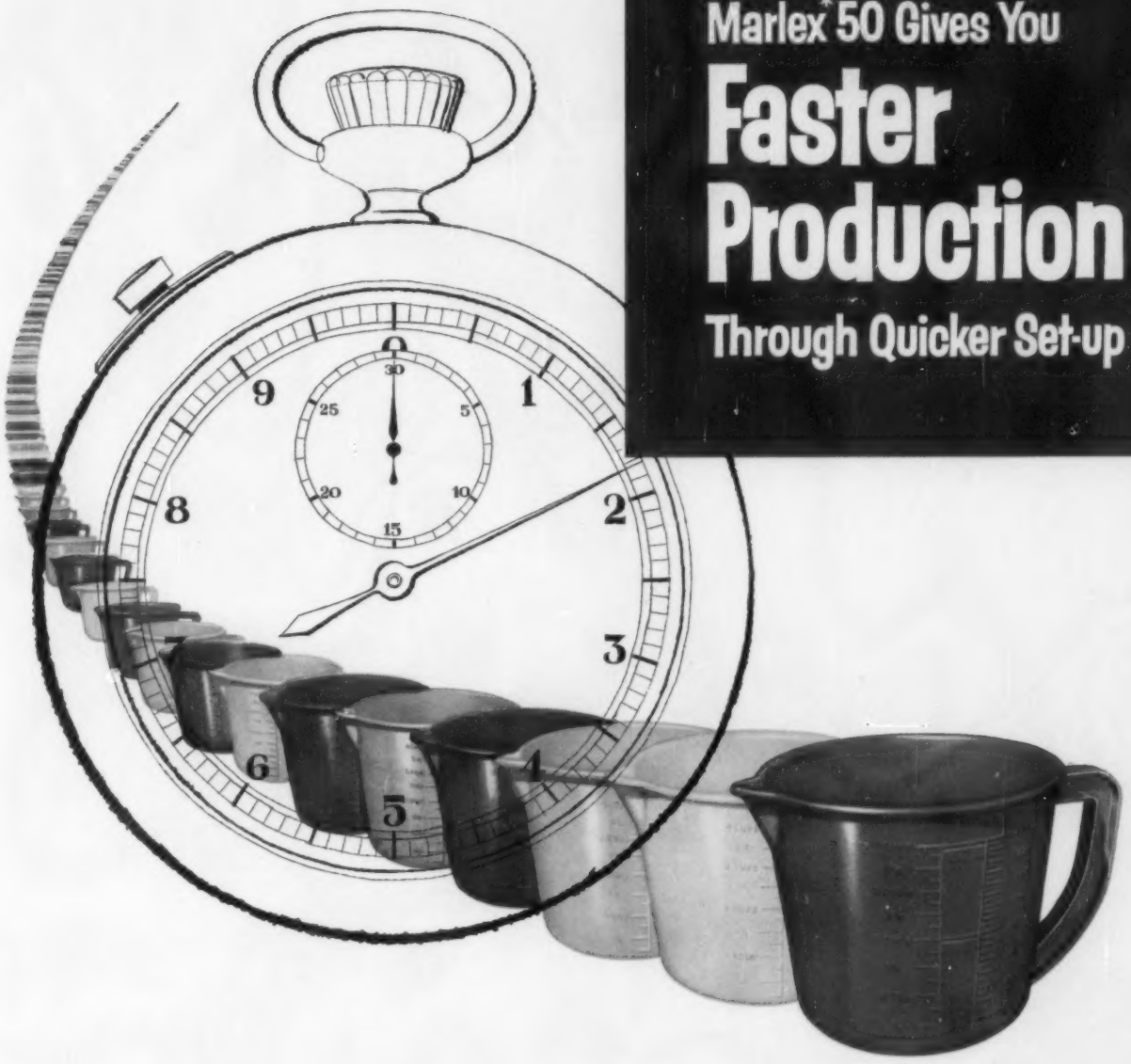
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High polish was the No. I requirement ...so the choice was Lustre-Die

The job sounded simple enough—turning out a plastic injection mold which would be capable of producing decorative bowl bases made of polystyrene plastic. But because the finished pieces were later to be silver-plated, it was imperative that the mold have the ability to take an unusually high polish.

We proposed Lustre-Die tool steel for two reasons. We were sure that, because of its properties and cleanliness, Lustre-Die would meet the polish requirements with plenty to spare. It was also logical to assume that it would save time in the shop, because of its easy machinability. The die-maker, Interstate Mold & Hobbing Co., Union, N. J., reported that the mold performed to their satisfaction on both counts.

Lustre-Die is an ideal tool steel for making plastic parts, primarily because its properties enable it to take such an unusually high polish. Lustre-Die is so bright-looking that it provides virtually the same effect as looking in a mirror.

Lustre-Die is the proper analysis for forming plastics, and is further enhanced by alloy fortification. It is heat-treated by oil-quenching and tempering to augment its properties. It comes ready for machining and polishing, ready to go to work. Lustre-Die steel is made in the electric furnace, and is carefully inspected to insure cleanliness. It is free from injurious porosity or surface pitting. Moreover, there's no need to be concerned about inclusion-causing additions.

If you would like to give Lustre-Die a trial run, get in touch with your Bethlehem tool steel distributor. He has Lustre-Die in stock, and can get it to you quickly.

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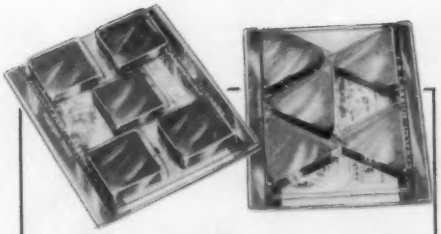
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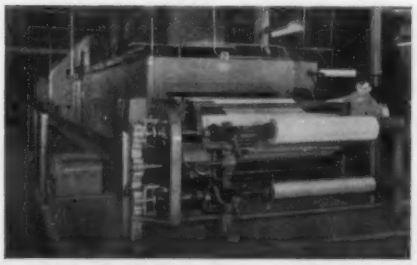


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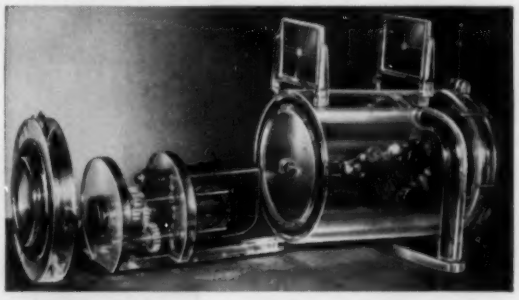


'Perspex' helps to picture the silent world

Photographing nature's deep water secrets sets special problems for camera design. That is why 'Perspex', the versatile I.C.I. acrylic sheet, has been used for this entirely new underwater camera case. Designed and manufactured by Stanley Plastics Ltd. Chichester.

'Perspex' eliminates completely the disadvantages of a conventional metal case - corrosion, condensation and obscured visibility. A full system of 'extended control' means that the camera can be operated with greater ease under water; and the prototype has been successfully tested at depths down to 200 ft. at a pressure of 95 lbs. per sq. in. The case is adaptable to nearly all types of camera.

This 'Perspex' ciné camera case is only one example of the way research is developing the use of I.C.I. plastics in all branches of industry.



This exploded view of the new underwater camera case shows the strips of fluorescent 'Perspex' framing the sights, here in the erect position. The clarity of the 'Perspex' cylindrical case allows lens settings to be seen without the provision of external markings or click stops.

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1938—Tenite Butyrate introduced. Extremely tough, high in impact strength, resilient, lightweight, lustrous, weather-resistant, dimensionally stable. Available in a wide variety of formulations and an almost unlimited range of crystal, transparent, translucent, opaque, metallic and variegated colors. Typical uses: steering wheels, business machine keys, tool handles, telephone housings, football helmets, industrial pipe, toys, marine floats.

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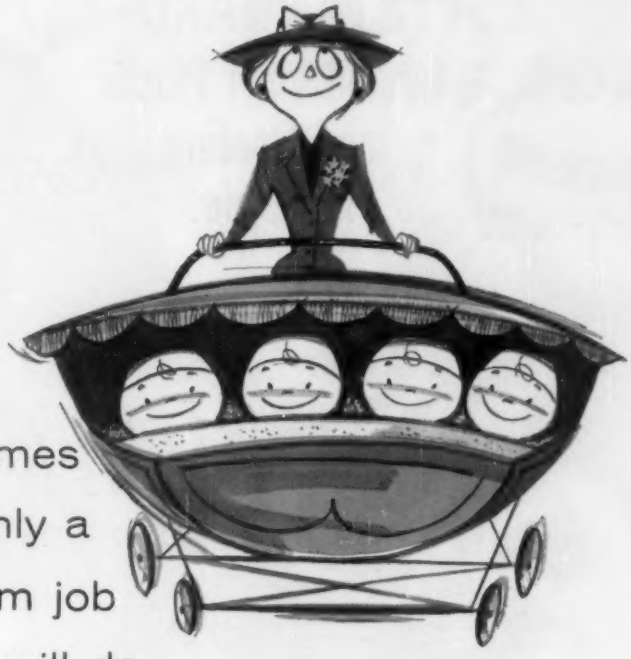
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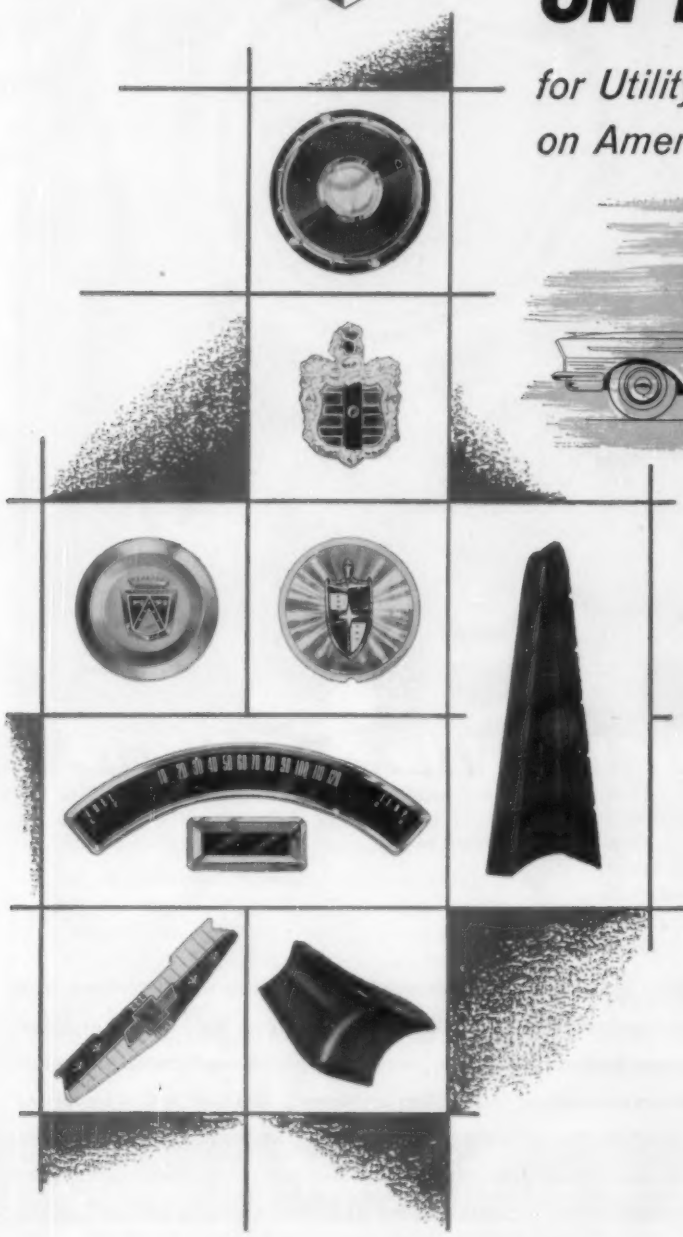
The HARSHAW CHEMICAL Co.

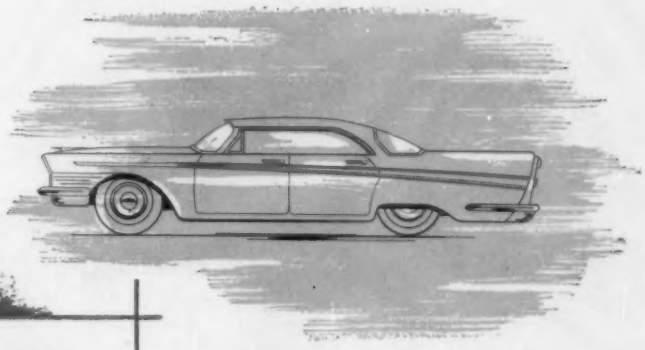
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for Utility and a Touch of Beauty on America's Most Popular Cars





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ERIE Three Dimensional Plastics in horn buttons, nameplates and ornaments are the last word in beauty . . . and the wide arc speedometer dial is given an added appeal by ERIE External Metallizing; an economical finish for plastic, equal in richness and lasting luster to electroplating on metal and with almost unlimited possibilities for application to other articles.

Write for a copy of the new ERIE Plastics Facilities Bulletin.

ERIE *Plastics Division*

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HOW CONVAIR PUT THE HEX ON HEAT

Hexcel glass-fabric honeycomb—long noted for its rigidity and excellent dielectric qualities—has a new use in Convair's B-58 Hustler. Heat resistant glass-fabric honeycomb—sandwiched between conventional metal skins—gave the Hustler's designers two big advantages in combatting heat in primary structures. **1**-Hexcel glass-fabric honeycomb core reduces internal temperature by as much as 40°. **2**-The glass-fabric sandwich presents a smooth surface for less air-friction...less heat. And, of course, the reduction in parts, (rivets, wing bracings, etc.), and improved structural efficiency through Hexcel Honeycomb sandwich construction saved thousands of pounds in the total weight of the plane. New shapes and new ideas in honeycomb sandwich construction—the result of engineering and research cooperation between Hexcel Products Inc., and Convair—contributed to the success of the Hustler. Hexcel's laboratories and sales-engineers are at the aircraft industry's immediate service.

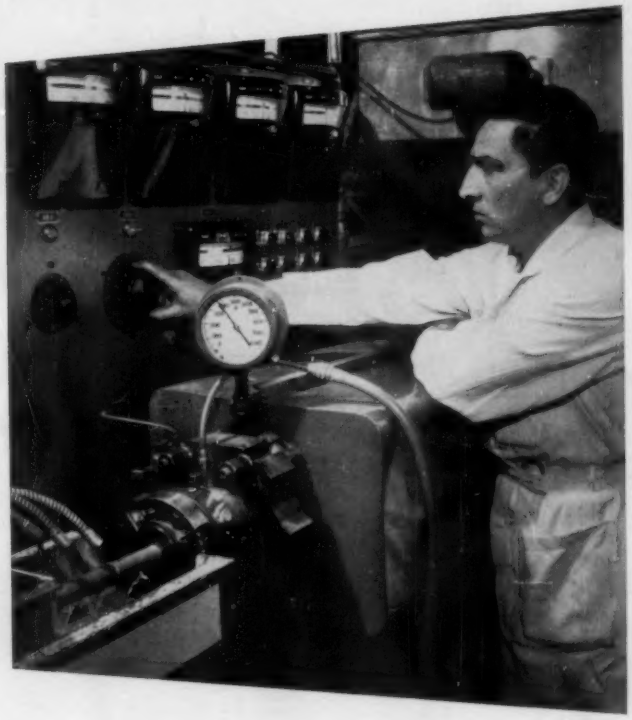
HEXCEL PRODUCTS INC.
America's leading producer of honeycomb core materials
951-61st Street, Oakland, California

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"Consistently close-tolerance extrusions from our NRM Thermoplastics EXTRUDERS"

...say the makers of Resinite®

Extruded Vinyl Products



The RESINITE Department of the Borden Company, Chemical Division, has plenty of experience upon which to base their above statement on the performance of NRM Plastics Extruders . . . they've used them almost exclusively since 1944 to "extrude their way" through four major plant expansions as the number and type of their popular-selling Resinite Vinyl products have increased.

When we asked Resinite officials about their experience with NRM Extruders we were pleased but not surprised at their spontaneous reply of "closer-tolerance extrusions," nor of their added remark: "NRM Extruders have *always* played an important part in our precision extruding, and today nearly all of our production is on NRM's."

We know that RESINITE'S experience with NRM Extruders is the typical experience of NRM users the world over . . . We know too, that NRM's patented "Balanced Heat Control," patented feed screw types and 20:1 Le/D ratio cylinders are reasons why NRM Extruders produce "consistently close-tolerance extrusions . . . " Yet these are only a few of the *many* advanced design and operating advantages that make it important in your profit picture that you "go NRM" the next time you purchase plastics extruding equipment.

WRITE FOR THE FACTS AND DATA ON OUR FULL LINE OF EXTRUDERS TODAY . . . NO OBLIGATION.

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NATIONAL RUBBER MACHINERY COMPANY

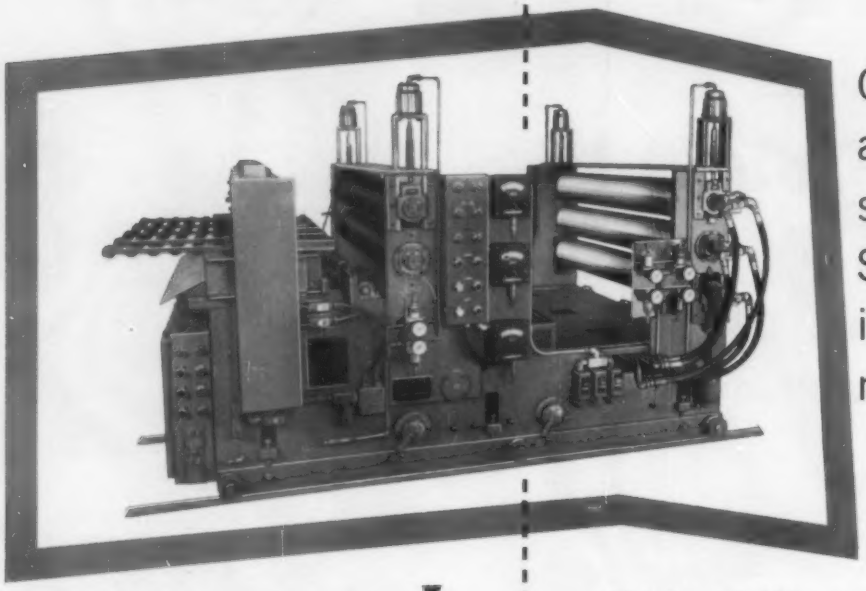
NRM

General Offices and Engineering Laboratories: 47 West Exchange St., Akron 8, Ohio
EASTERN PLANT: 384 Getty Ave., Clifton, N. J.
SOUTH: The Robertson Company, Rutland Building, Decatur, Ga.
WEST: S. M. Kipp, Box 441, Pasadena 18, Cal.
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Combined as you see it... Separated if you need it!

▼ Each set of rolls is driven by individual variable speed drives through a heavy duty worm gear arrangement, providing roll speeds to suit extruder.

▼ Finishing rolls — chromium plated, super-finished, jacketed for water, steam, oil heating or cooling.

▼ Top and bottom rolls vertically adjustable — air or manual.

▼ Shear is air or hydraulically operated and travels with sheet to eliminate buckling.

▼ Built-in (3) Zone heat exchanger. Sheet trimmer. Film wind-up.

This latest Robbins combination is being used for production of top quality sheet and laminating. Shown here as a unit, the Chromium Roll and Rubber Roll Shear can he mounted on individual bases for positioning that best fits your needs. Used with other Robbins individual units or special attachments this combination has the flexibility to meet your requirements. Robbins dies and haul-off equipment can be used with all makes of extruders now on the market.

Robbins
never say die... say Robbins die

SHEETING DIES A SPECIALTY

PLASTIC MACHINERY CORP.

1430 Mishawaka Street

Elkhart, Indiana



EXON 470...specifically for protective coatings at lower costs

...typical of the Pin-Pointed Properties in Exon Vinyl resins

Manufacture of solution protective coatings takes a giant stride toward simpler processing and lower costs when you use Exon 470. You no longer need several resins to get the best properties of them all. One is enough . . . Exon 470.

With only one resin to work with, production control is simplified. Costs drop. At the same time you cut your inventory expenses. You produce a better product with outstanding solution characteristics.

Here are just a few of the important properties combined in Exon 470: Adhesion to metal, alkyd and vinyl surfaces. High solubility in aromatic hydrocarbons. Alkyd compatibility. Excellent pigment dispersion properties. Abrasion, acid and alkali resistance. Fast baking . . . medium fast drying. Oil, grease and salt-spray resistance. Low moisture vapor permeability. Outdoor durability. Now you need only one resin . . . Exon 470 . . . to make better solution coatings at lower costs.

Exon 470 is just one of the many resins in industry's most complete line of versatile vinyls. It is another reason why industry looks to Firestone for engineering answers to its needs.

Consider your own production problem. Then, for resin properties pin-pointed to the best answer for you, check with Firestone.

Firestone

EXON

RESINS

For complete information and technical service, call or write:

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DEPT. 72J, POTTSTOWN, PA. • A DIVISION OF THE FIRESTONE TIRE & RUBBER CO.

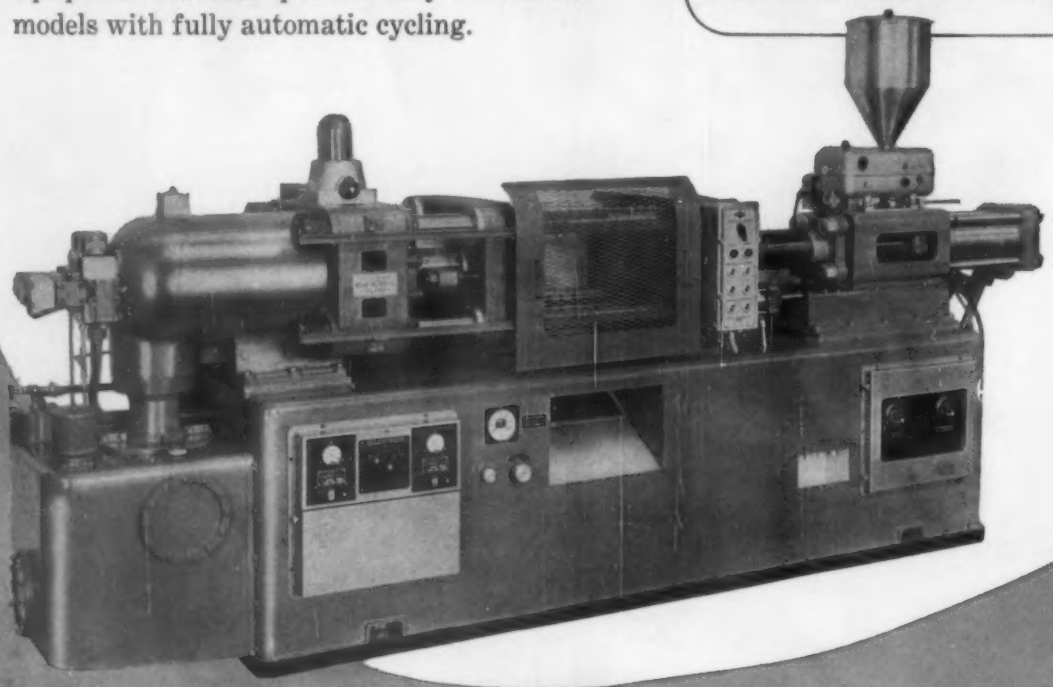
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R. 12 F.A. Fully automatic injection press – capacity 4 to 6 oz. – fast operating cycles (8 shots a minute)





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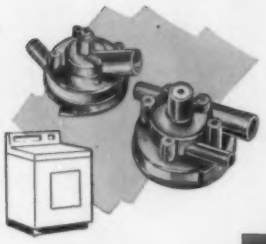
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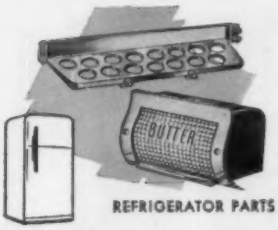
U.S.A.—Acme Machinery & Manufacturing Co., Inc.
102 Grove Street, Worcester, Mass.
Phone: PLeasant 7-7747
New York Office: 2315 Broadway
Phone: SUsquehanna 7-1705

Canada—Plastics Equipment & Accessories
1362 Jean Talon Est.
Montreal 35, P.Q.
Phone: CRescent 4-8274

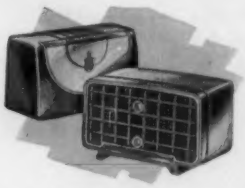
NB&C NEGRI BOSSI & CO., MILANO (ITALY)
Corso Magenta, 44
Cable address: Gianimar



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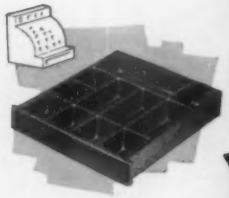
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APPLIANCE HANDLES



VACUUM CLEANER NOZZLES



CASH REGISTER DRAWERS



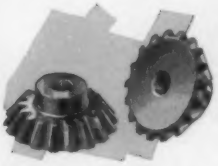
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TEXTILE MACHINERY PARTS



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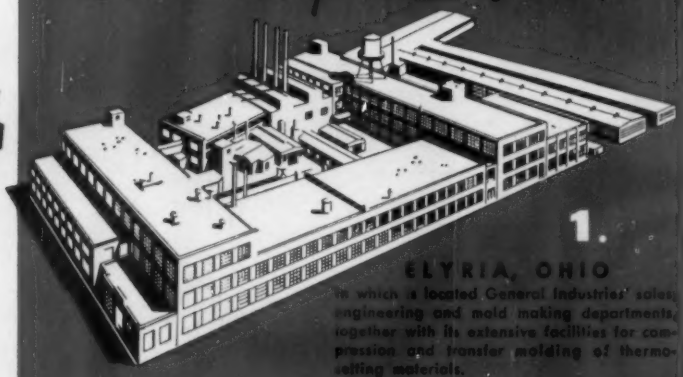


INDUSTRIAL GEARS



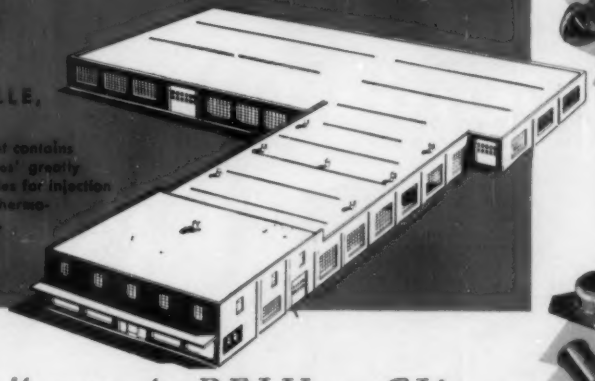
ELECTRICAL PARTS

NOW...TWO modern plants to produce your custom molded plastics *Efficiently... Economically... On Time!*



1. ELYRIA, OHIO

...is which is located General Industries' sales, engineering and mold making departments, together with its extensive facilities for compression and transfer molding of thermosetting materials.



2. MARYSVILLE, OHIO

This modern plant contains General Industries' greatly expanded facilities for injection molding of all thermoplastic materials.

...it pays to RELY on GI!

- **COMPLETE ENGINEERING SERVICE**
- **COMPRESSION MOLDING** 150 presses ranging up to 1850 ton capacity.
- **INJECTION MOLDING** 17 presses ranging up to 200 oz. capacity.
- **FINISHING EQUIPMENT** Automatic facilities include equipment for trimming, polishing, buffing, drilling, tapping, tumbling and painting.
- **MOLD MAKING FACILITIES** General Industries' own tool and die shop is capable of producing all types of high quality custom molds and dies.

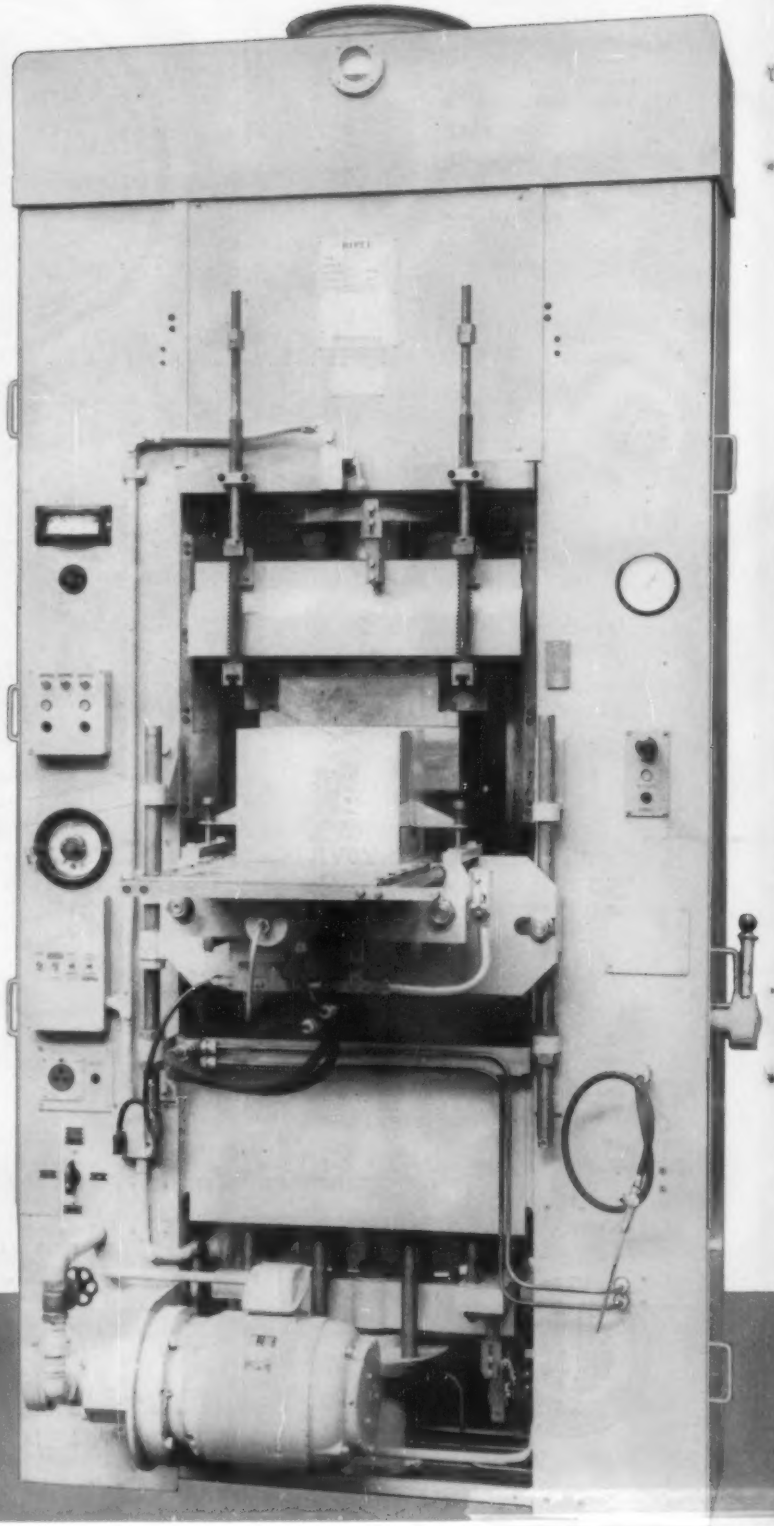
THE GENERAL INDUSTRIES CO.

PLASTIC DIVISION • ELYRIA, OHIO

FASTER CYCLES IN HALF THE SPACE!

Brand new from Bipel . . . faster *fully automatic* operation, in half the usual floor space!

Feeding and stripping tables are designed to permit full length strokes from short stroke cylinders with no overhang beyond the ends of the stripping and loading plates. The cycle is remarkably fast, yet plates are accelerated and decelerated gently.



BIPEL *Automatic*

COMPRESSION TRANSFER PRESS

For added convenience all automatic units can be swung clear to the side, permitting the mold setter to stand right up to the press. These units may be adjusted vertically to suit tool height. Top or bottom ejection may be selected with a single plug-in. Operation may be changed from automatic to semi-automatic, or manual at the flick of a switch.

More economical to buy and easier to maintain, these new BIPEL automatic presses are available in two models, permitting infinitely variable pressures up to 71 or 168 tons maximum. For speed, economy and complete flexibility be sure to see BIPEL, first!

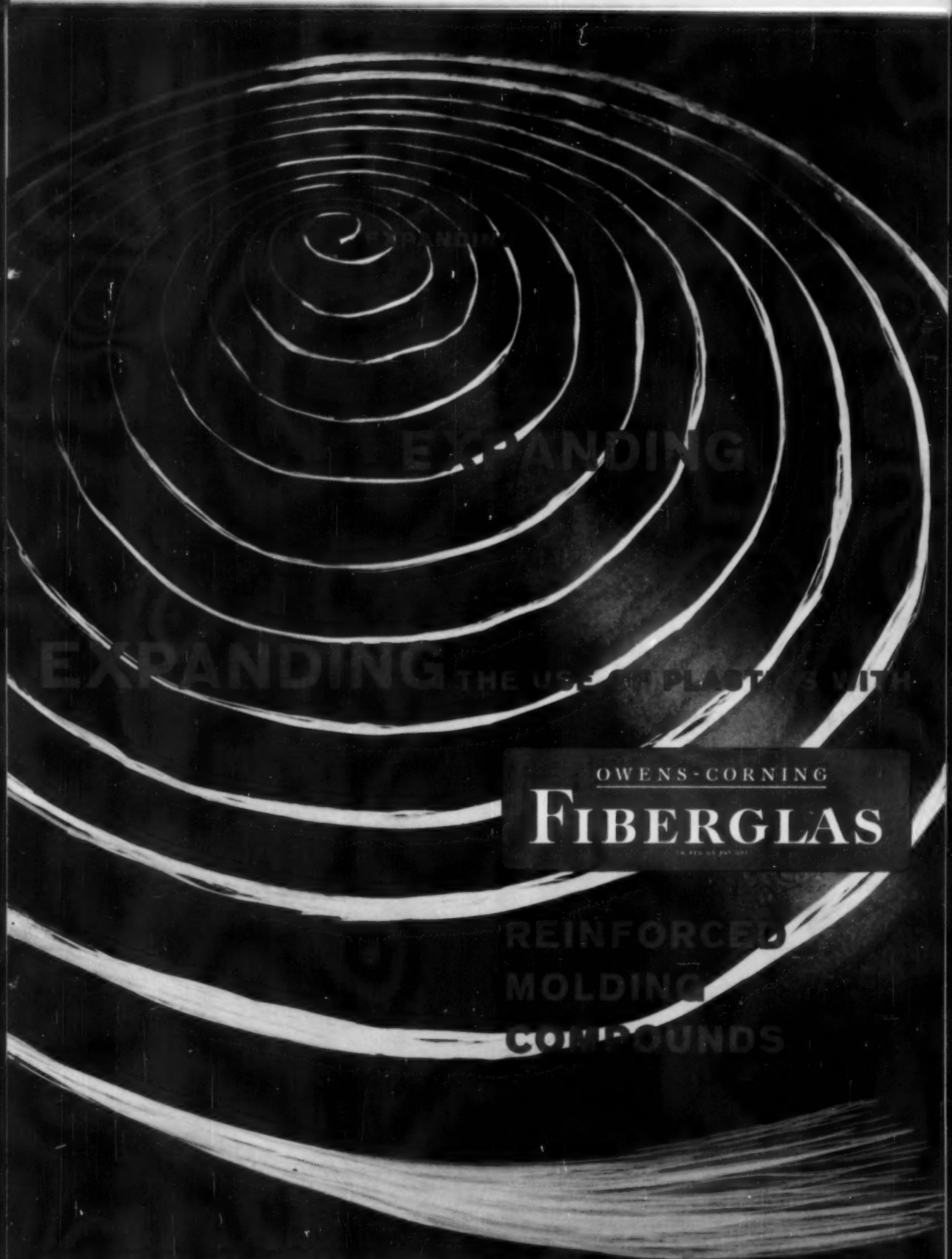
DEMONSTRATIONS AND SERVICE FACILITIES AT TIVERTON.

B.I.P. ENGINEERING LTD., Sutton Coldfield, England

Canadian Inquiries to:
JOHN SPERLING & CO., 739 Mountain St., Montreal 3, Que.

American Inquiries to:
RALPH B. SYMONS ASSOCIATES, INC.
3571 Main Road, Tiverton, R. I.

..this is **BIPEL**



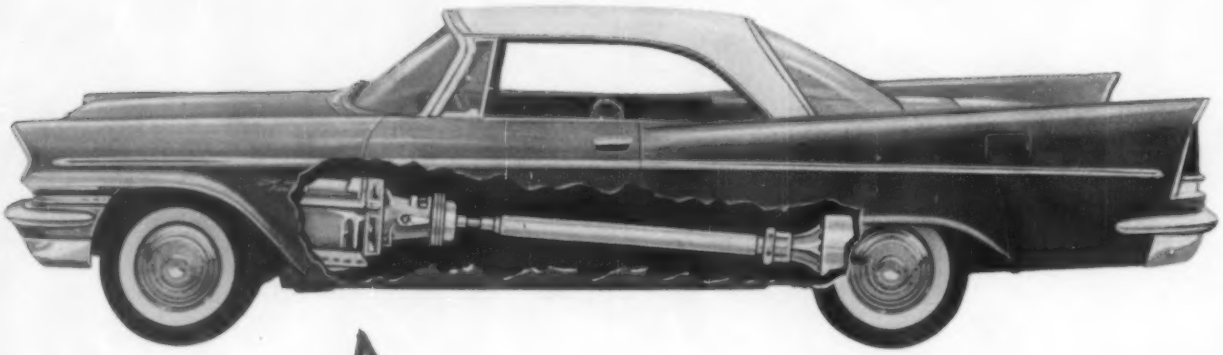
SEE HOW THEY SOLVE PRODUCT DESIGN PROBLEMS...

PLASTIC MOLDING COMPOUNDS with Fiberglas rein-

Yet Fiberglas-reinforced molding compounds have all the good

ALL THE PROPERTIES OF PLASTICS...PLUS

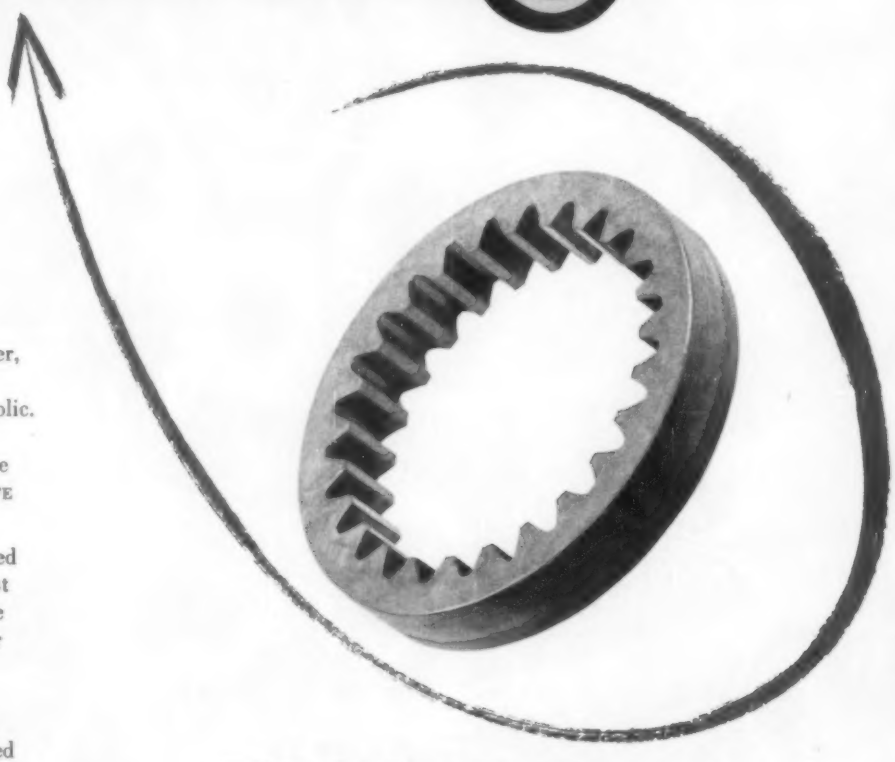
- ✚ Heat Resistance
- ✚ Strength
- ✚ Dimensional Stability



Carries the load under heat and pressure . . .

Deep down inside every new Chrysler, you'll find this hard-working gear molded of Fiberglas-reinforced phenolic. It's a vital part of a pump which maintains high hydraulic oil pressure to operate the Chrysler's POWER-FLITE and TORQUEFLITE transmissions.

Every property of Fiberglas-reinforced molding compounds is put to the test in this application. To do its job, the gear must show super strength, wear resistance, heat resistance and dimensional stability. Fiberglas-reinforced phenolic measures up on every score. Not only has this molded gear resulted in substantial cost savings, but it also makes much less noise than the metal gear it replaces.



END USER: Chrysler Corporation, Detroit, Michigan

MOLDER: Willow Run Rubber & Lining Company, Belleville, Michigan

MOLDING COMPOUND: Durez Fiberglas-reinforced phenolic by Durez Plastics Division, Hooker Electrochemical Company, North Tonawanda, N.Y.

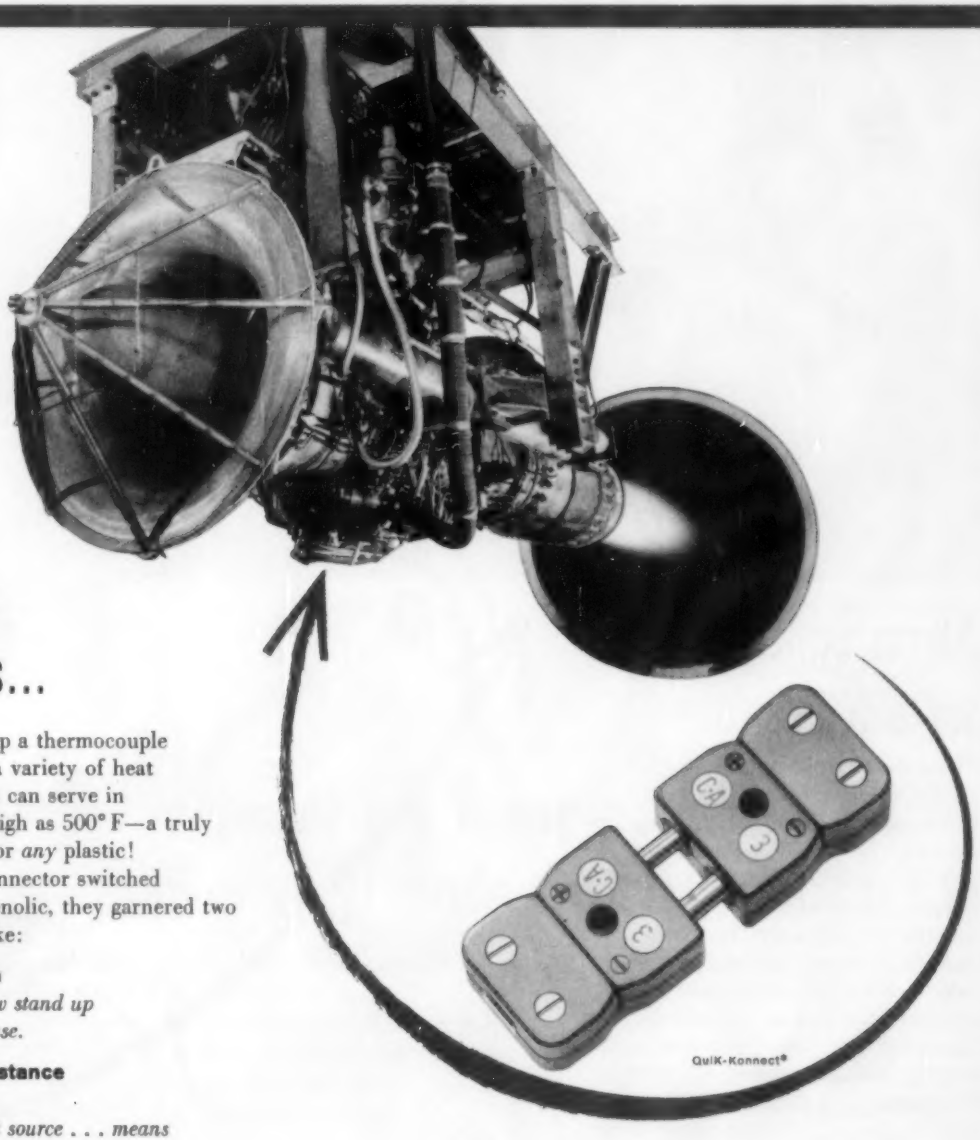
OWENS-CORNING
FIBERGLAS

REINFORCED

Reg. U. S. Pat. Off.) O-C. F. Corp.

PLASTIC MOLDING COMPOUNDS with Fiberglas reinforcement have surmounted many of the limitations which molded plastics impose on the designer. For Fiberglas-reinforced molding compounds make products that are far stronger . . . more resistant to temperature extremes . . . with better dimensional tolerances and stability than have ever before been possible. In effect, they are opening up a whole new world of design opportunities.

Yet Fiberglas-reinforced molding compounds have all the good properties, processing advantages and economies you associate with molded plastics. They're formed in standard transfer, injection or compression molding equipment and introduce no new problems in handling or processing. On these pages, you see a few of the many new products designed with Fiberglas-reinforced molding compounds to attain all the properties of plastics . . . plus!



Measures white heat at close quarters...

This plug and jack make up a thermocouple connector widely used in a variety of heat measurements—both parts can serve in ambient temperatures as high as 500° F—a truly astonishing performance for *any* plastic! When designers of this connector switched to Fiberglas-reinforced phenolic, they garnered two big advantages at one stroke:

1. Much greater strength
means the connector can now stand up through years of everyday use.

2. Spectacular heat resistance
enables the connector to be used much closer to the heat source . . . means much more accuracy in measurement.

Here you see an excellent example of the improvement in plastics performance that stems from Fiberglas-reinforced molding compounds. The molding operation on these parts is normal. The complicated shapes are transfer-molded from pre-formed pills in standard equipment.

MOLDER: Marlin Manufacturing Co., Cleveland 11, Ohio

PRODUCT MANUFACTURER: Minneapolis-Honeywell Regulator Co., Brown Instrument Division, Philadelphia, Pa.

MOLDING COMPOUND: Fiberglas-reinforced phenolic by Fiberite Corporation, Winona, Minn.

*Trademark, Minneapolis-Honeywell Regulator Co.

MOLDING COMPOUNDS

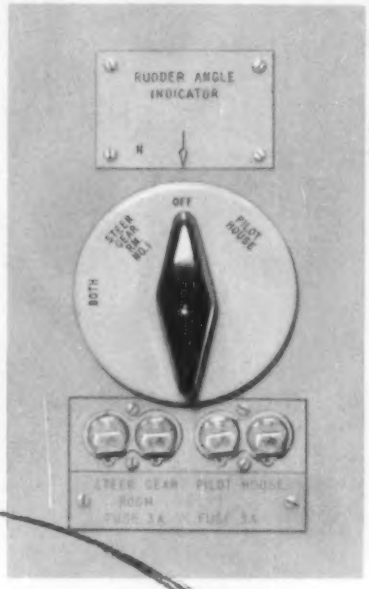
VINYL FOAM
(open-cell)

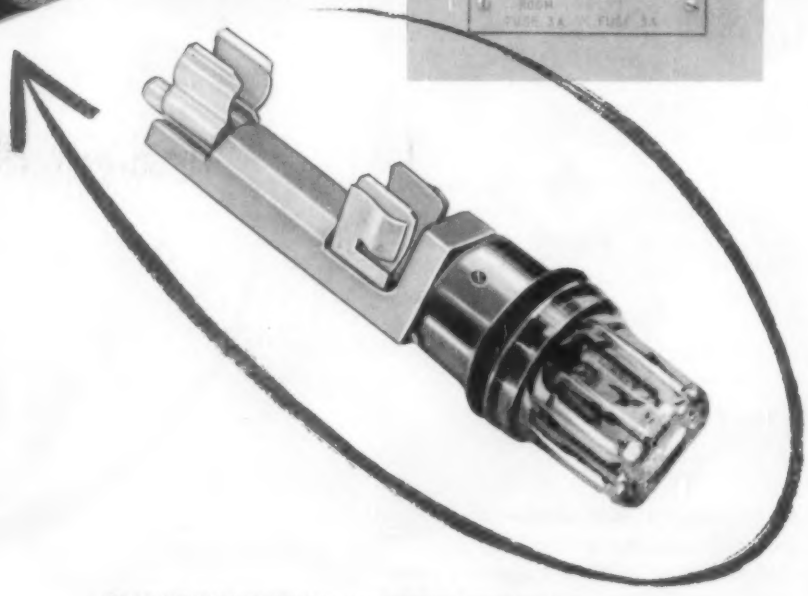
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ALL THE PROPERTIES OF PLASTICS...PLUS

- ✚ Heat Resistance
- ✚ Strength
- ✚ Dimensional Stability







Alarm light for a blown fuse

When the fuse blows inside this fuse holder, a light glows and the trouble can be quickly corrected. These holders are now widely used on switchboard and control panels in industry, aboard ship and in military aircraft. Designers of this assembly needed a material that combines shock resistance with excellent dielectric properties. And since the fuse carrier must fit snugly into the base, dimensional stability is also important. Fiberglas-reinforced alkyd fills these requirements and, in addition, offers high resistance to heat, moisture and electric arcing. Again, a Fiberglas-reinforced molding compound makes a new design possible!

PRODUCT MANUFACTURER: Fuse Indicator Corporation, Boston, Mass.

MOLDER: Engineered Plastics, Inc., Watertown, Mass.

MOLDING COMPOUND: Fiberglas-reinforced Plaskon Alkyd by Barrett Division, Allied Chemical & Dye Corporation, New York, N.Y.

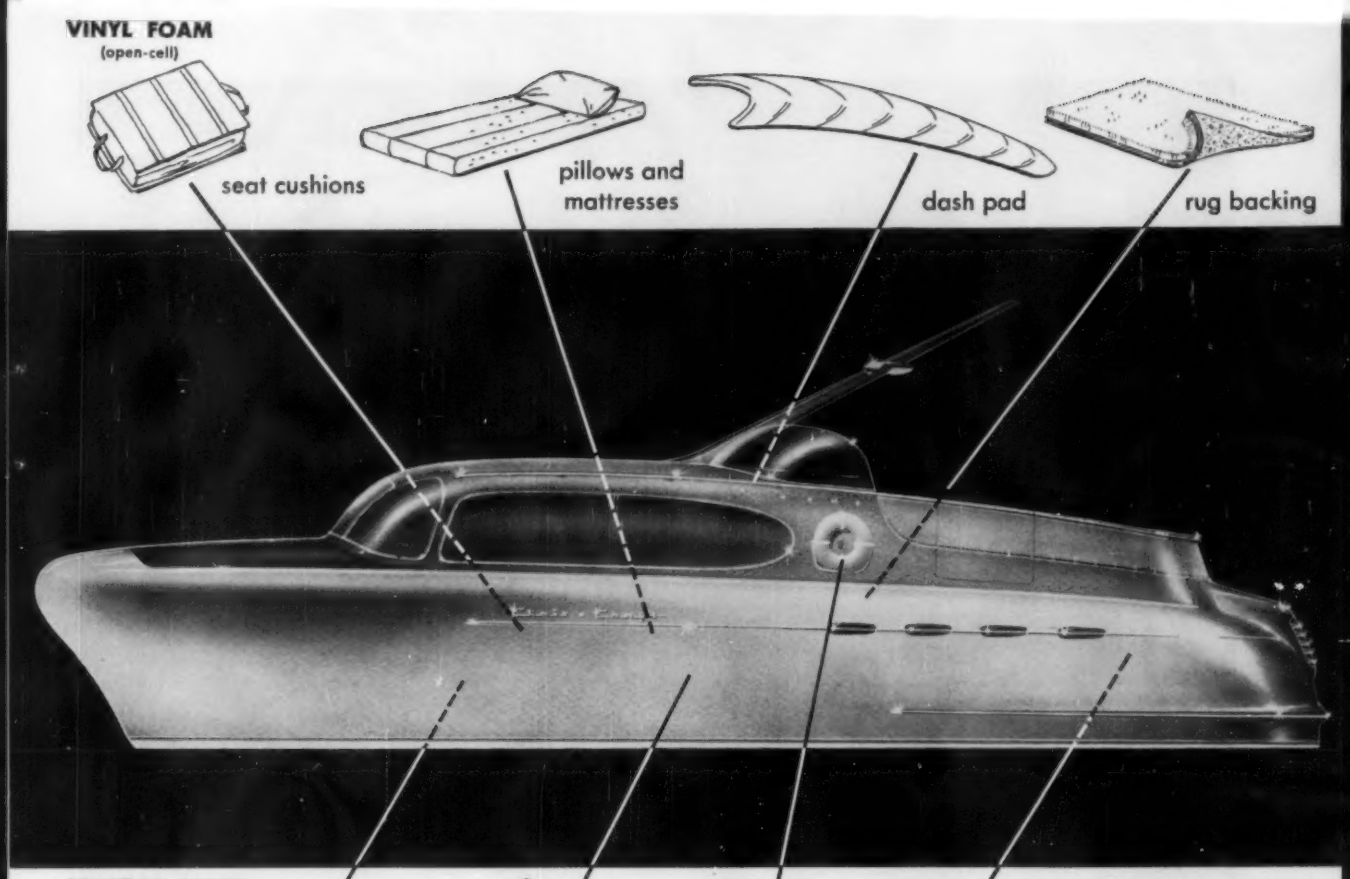
THE CASE HISTORIES on these pages illustrate just a few of the thousands of products which have been profitably fabricated with Fiberglas-reinforced molding compounds. Write now for our complete file of case histories and a list of suppliers of Fiberglas-reinforced

TEXTILE PRODUCTS DIVISION
Dept. 125-G, 598 Madison Ave., N.Y. 20, N.Y.

Owens-Corning Fiberglas Corporation produces only the reinforcement for the manufacturers of reinforced molding compounds.

OWENS-CORNING
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Owens-Corning Fiberglas Corporation produces only the reinforcement for the manufacturers of reinforced molding compounds.



CHRIS CRAFT DESIGN ENGINEERS sketched this futuristic "dream boat" for us to point up some of the many possible marine applications for expanded PVC.

Aboard this dream cruiser are many possible uses for vinyl foam and cellular vinyl made with DuPont BL-353

From fittings for luxury yachts to toys and novelties at the nearest "five and dime," the market for vinyl foam and cellular vinyl grows bigger every day.

Many Uses

Here, for example, are a few other possible uses for chemically expanded vinyls:

1. Automotive protective padding
2. Rug and Carpet backing
3. Insulated clothing
4. Furniture and upholstery padding
5. Soles and interlinings for shoes
6. Athletic padding
7. Heat-sealable fillers

Advantages of DuPont BL-353

This general-purpose blowing agent produces vinyl foam and cellular vinyl with fine, uniform cells in either thick or thin sections over a broad range of densities. It also offers excellent expansion efficiency in producing items of either vinyl foam or cellular vinyl. And when making free-blown vinyl foam with DuPont BL-353, there is no need for specialized processing equipment.

DU PONT BL-353

DU PONT
REG. U. S. PAT. OFF.

Better Things for Better Living
. . . through Chemistry



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New "Dutch Boy" Stabilizer team... new quality for automotive grades of vinyl film and sheeting

Here's the latest from "Dutch Boy" research ... two new "Dutch Boy" Stabilizers especially suitable for automotive vinyls, including "clears".

Flomax* 25 . . . a new and different barium-cadmium organic complex . . . remarkable for clarity, for economy. Flomax 25 gives you outstanding heat and light stabilization combined with freedom from yellowing and plate-out.

Nalzin* is an effective new zinc organic co-stabilizer that prevents sulfur staining.

In calendered stocks, these "Dutch Boy" non-lead Stabilizers team up to assure quality that reaches or exceeds automotive standards. What's more, they do so with outstanding economy.

Both, for example, are easy to incorporate and disperse. They're liquid . . . miscible in and compatible with common plasticizers and solvents.

Both are ideal, too, for cost and efficiency . . . suitable for high-quality, low-cost formulations.

Where unusually high heat stability is a requirement . . . or sheeting is unusually heavy . . . other "Dutch Boy" barium-cadmium Stabilizers, Provinite*, and Clarite* are widely used. Both provide an extra measure of heat stability.

If you produce automotive or furniture upholsteries, luggage or heavy-duty film stocks, you may want to know more about these and other "Dutch Boy" Stabilizers for vinyls. A new "Dutch Boy" Stabilizer Handbook gives full details, including formulae. Write for a copy.

National Lead also provides technical assistance in the use of these "Dutch Boy" Stabilizers.

Dutch Boy® CHEMICALS

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Now—At Last...

MASSIVE NYLON MOLDINGS

Now with New Spencer Nylon you can injection-mold big void-free pieces that are

- **LIGHTWEIGHT**
- **DURABLE AS METAL**
- **CORROSION RESISTANT**



Giant vs. Dwarfs! Photo shows nylon moldings of conventional size, compared to the huge sizes now possible with new Spencer Nylon. Combining metal-durability with plastic-lightness, these big new injection-moldings can be price-competitive with metal.

A new kind of nylon now makes it possible to produce injection-molded pieces weighing pounds instead of ounces. This means you can make nylon pieces with larger surface areas and thicker cross-sections than ever before possible. This development is of major significance to the plastics industry, for it brings into range such multi-million-pound targets as cases for portable radios, motor boat propellers, conveyor belt links, electric motor housings, and other large items made of metal.

Such massive moldings have long been needed, for nylon combines the durability of metal with the feather-lightness of plastics. In properly designed applications where friction is involved, nylon works better than metal, for it is self-lubricating and abrasion-resistant.

Nylon often offers real economy in the cost of finished pieces. As compared with metal, its low specific gravity permits the production of more parts per pound. Manufacturing cost is cut by molding to close tolerances, rather than machine finishing. Thus, despite nylon's relatively high cost per pound, it is frequently possible to produce nylon parts at a substantially lower cost than metal.

But until recently, it has been impossible to supply these profitable big-piece moldings. At molding temperature ordinary nylon is highly fluid, making it difficult to handle. And because it solidifies so quickly, large void-free moldings have been hard to produce.

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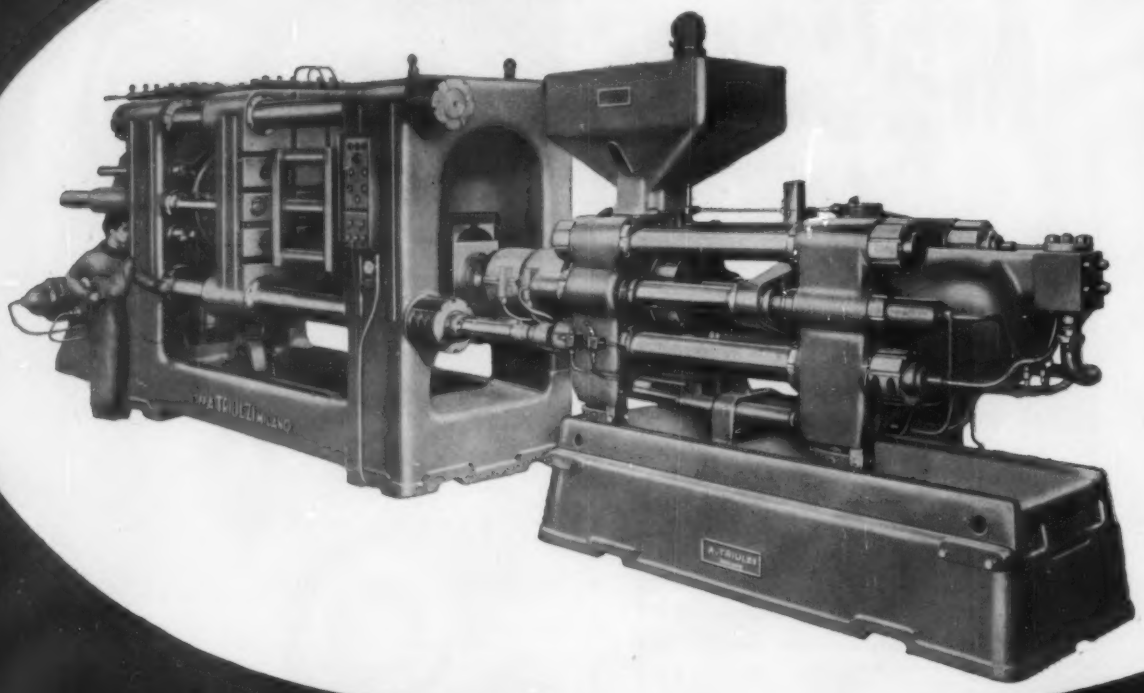
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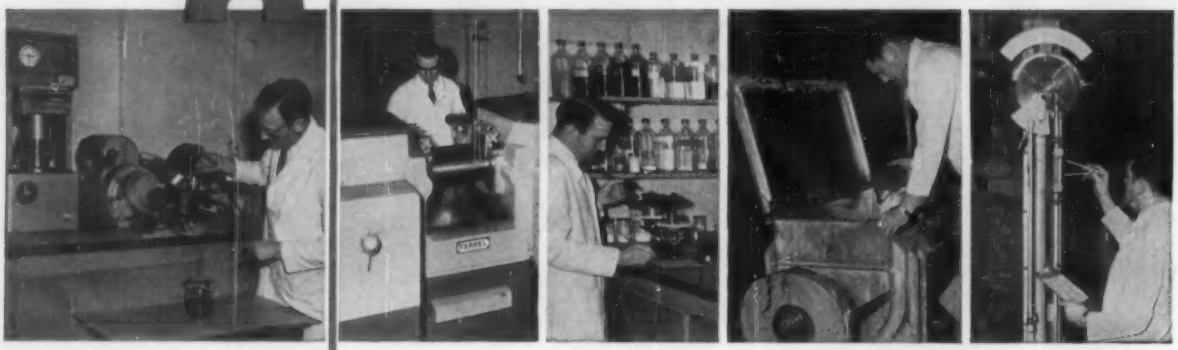
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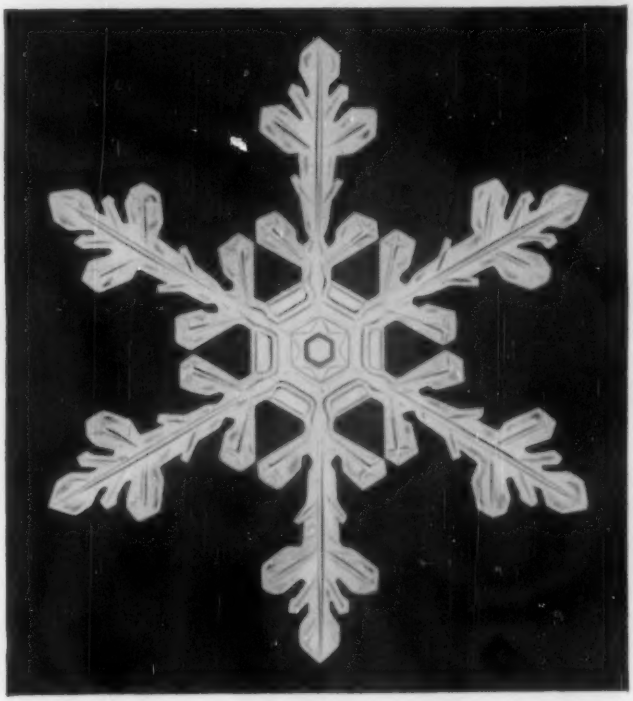
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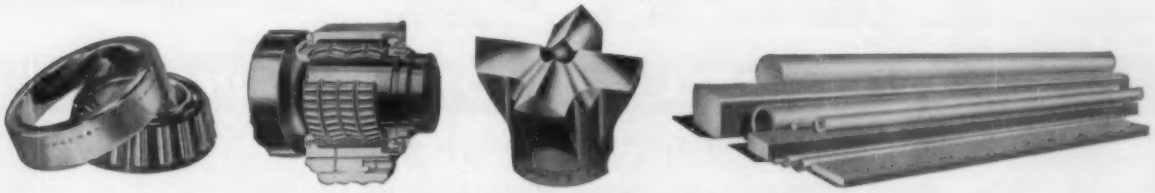
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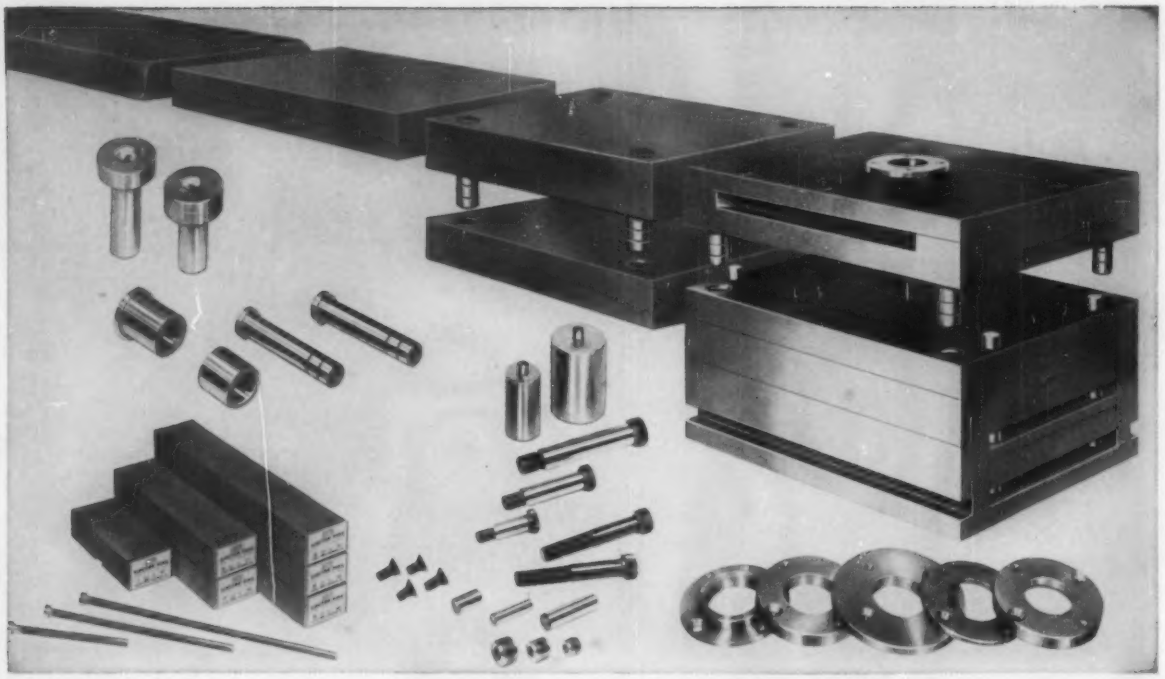
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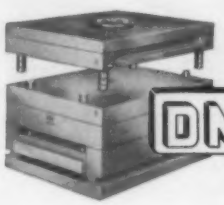
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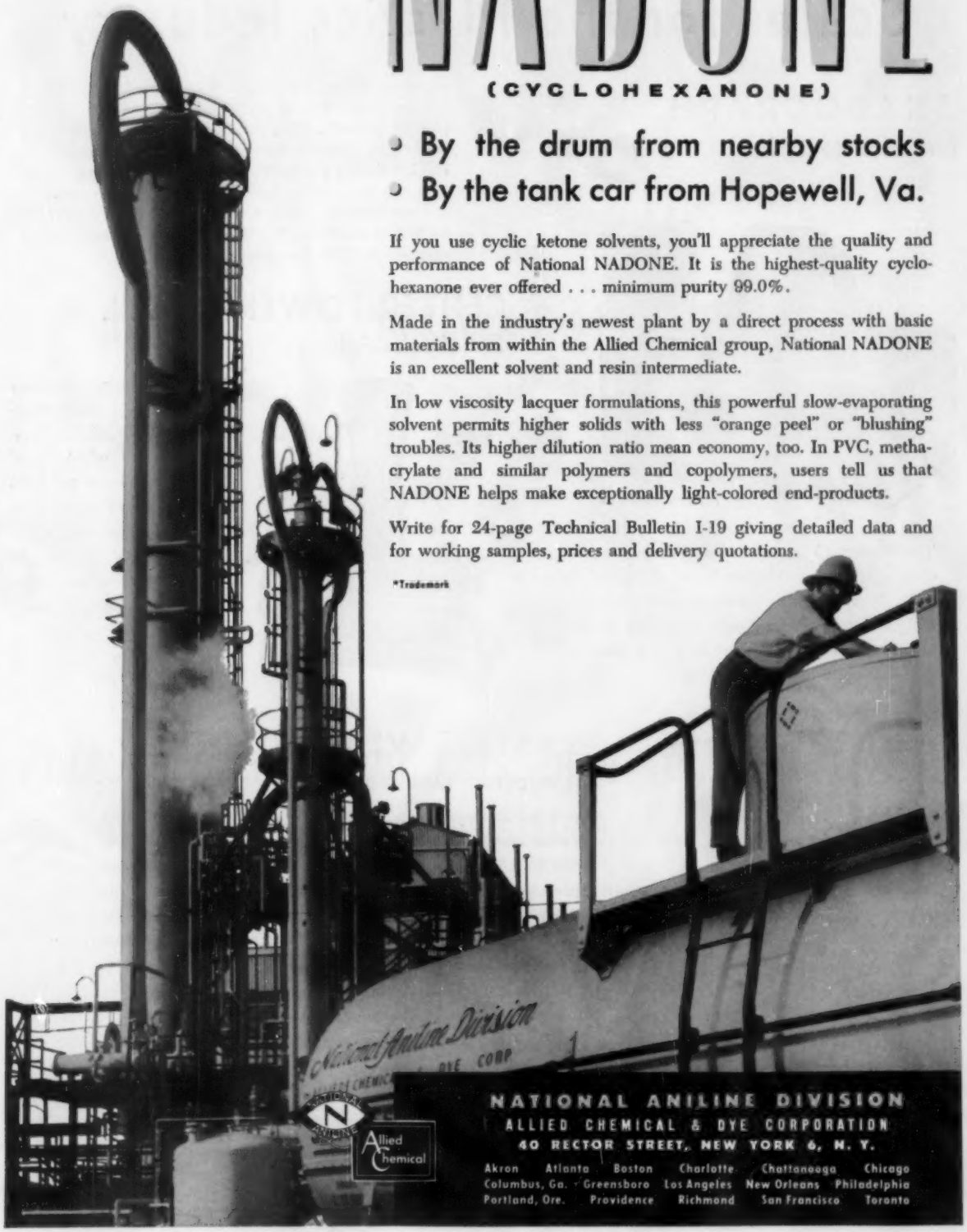
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Write for 24-page Technical Bulletin I-19 giving detailed data and for working samples, prices and delivery quotations.

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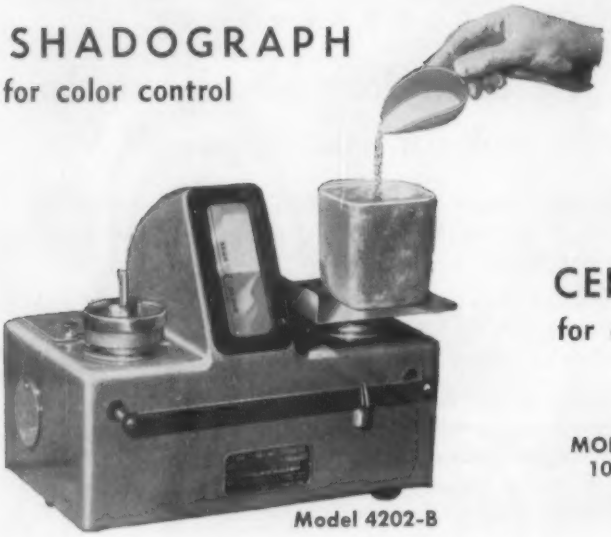


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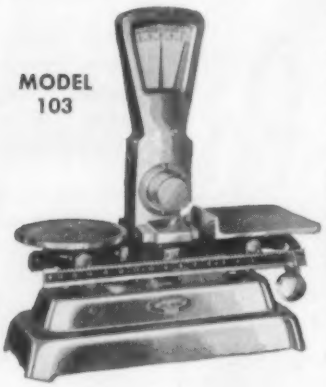
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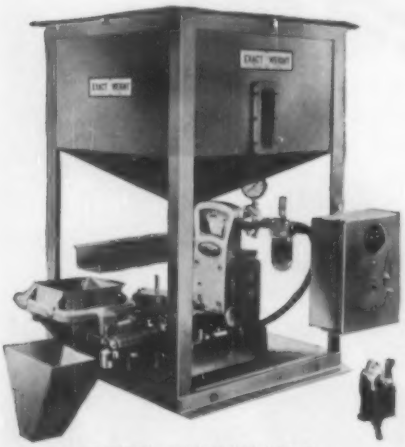
Shown on this page are only a few models from the broad line of Exact Weight Scales made specifically for the plastics industry. They include specialized models for pre-weighing plastic materials, for pre-form production, check weighing pre-forms, counting parts by weight, bagging and drum filling, color blending, weigh feeding.

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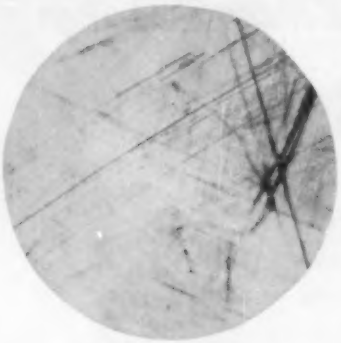
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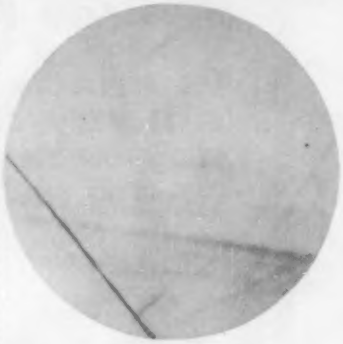


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24 MONTHS' EXPOSURE



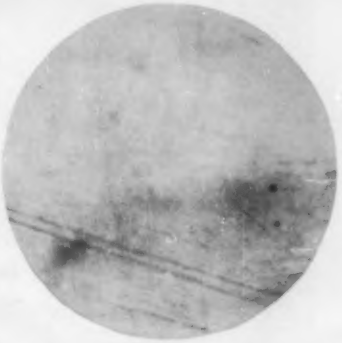


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Virtually no change after two years' exposure—that's the outstanding record of PARAPLEX® P-444 acrylic-modified polyester, as shown by these magnified (60 times) photographs of the surfaces of exposed and unexposed panels. Deterioration of conventional light-stabilized resins A and B resulted in minute cracks and crazes which cause erosion and bared fibers.

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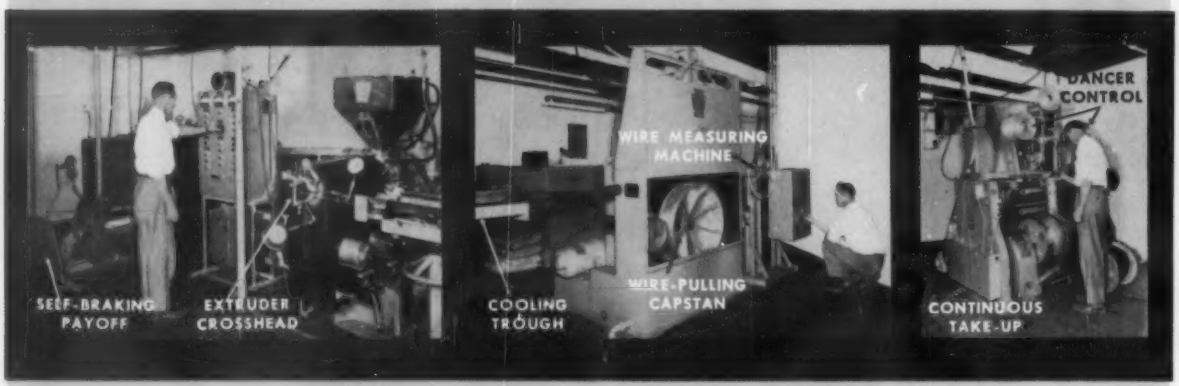
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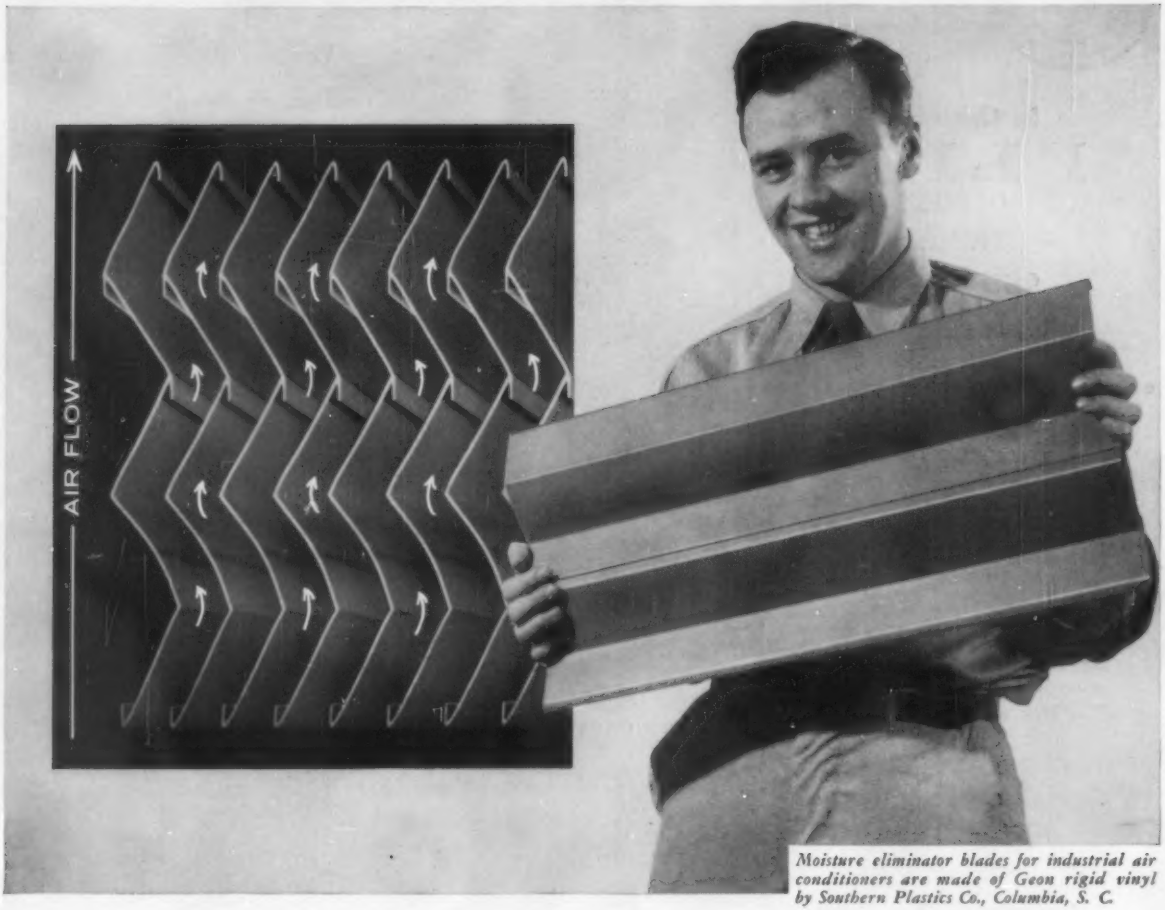
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blades of Geon keep air dry...end replacement problems

THESE moisture eliminator blades for industrial air conditioners are now made of Geon rigid polyvinyl chloride compound — to end frequent replacement of formed sheet metal blades.

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MODERN PLASTICS
Volume 34
July 1957
Number 11

Bigger and better crops with less work and lower costs thanks to

PLASTICS' GREEN THUMB



Polyethylene film, shown used for holding ball of dirt around tree roots, has joined burlap, paper, and peat moss in the nursery. (Photo, Jet Specialty)

The history of agriculture in the United States is one of perpetual revolution. Only seventy-five years ago it took three farm workers to raise enough food to feed themselves and one city worker; today agricultural technology has brought us to the stage where one farm worker can produce enough food for the sustenance of 18 persons.

First came the replacement of manpower and animal power by motorized horsepower. Next came the agricultural chemicals, modern fertilizers, soil conditioners, insecticides, and selective weed killers. The development has been reflected in farm investment. Fifteen years ago, the average farm represented an investment of $3500 per worker in land and equipment; today, investment averages some $15,000 or more per worker on many farms.

The latest phase of the revolution in agriculture involves the continually increasing use of

New greenhouse glazings



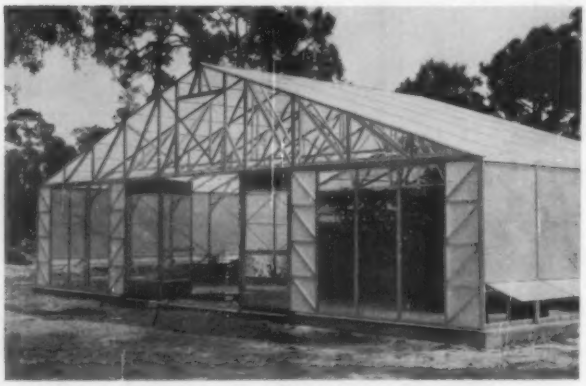
Extruded oriented styrene-acrylonitrile copolymer sheet on light frame makes strong, permanent greenhouse. (Photo, Plax Corp.)



Do-it-yourself greenhouse is 8 by 10 ft. in size, costs about $50 to build using polyethylene film and rough lumber. (Photo, Bakelite)



Translucent polyethylene film is draped under conventional greenhouse roof, serves to provide heat insulation and prevent pipe condensation. (Photo, Gering Products, Inc.)



Glass-reinforced polyester sheets, made to exact specifications, are used with aluminum framing in construction of permanent greenhouse. (Photo, Russell Reinforced Plastics)

plastics materials, chiefly film and sheet, to increase production, to conserve moisture and soil, to lower labor content of crops, and to bring about significantly lower costs.

At every agricultural experiment station in the country work on film mulches, crop covers, silos, and greenhouses has been going on.[1] Dr. C. E. Staff, agricultural authority connected with Bakelite Co., recently declared that "millions of acres of crop land are likely to be covered with polyethylene film in the next decade, and this can mean sales in the millions of dollars for the plastics film and sheeting industry."

Silos and silo covers

Both vinyl and polyethylene films have demonstrated their adaptability for plastics silo covers, fast becoming one of the major agricultural outlets for these materials. Although much early work was done with vinyl films, present emphasis is strongly on polyethylene.

[1]See "Film on the farm," MODERN PLASTICS 34, 112 (Sept. 1956).

Over a period of eight years, a Purdue University dairy department research team conducted a detailed investigation of the use of polyethylene film as a cover for trench, bunker, and other types of low-cost, easily erected silos. Silage produced under this "Purdue method," is of high quality and is produced at a cost far below that which the average farmer now pays for this product.

The Purdue researchers point to the use of the plastics silos for two purposes—first, as primary storage for silages, and secondly, to increase storage capacity. Such plastics silos may be built with a minimum of labor and equipment and located at sites convenient for both making and feeding the silage. The capacity of the silos is flexible; they can hold silage in amounts ranging from a few tons to over 100 tons.

There is a definite trend today toward increased use of grass and forage crops in livestock feeding. This emphasis on grassland farming is an important step in conserving topsoil and producing large quantities of high-quality livestock feed. Grass silage preserves the green forage crop with a minimum loss of nutrients, provides high quality, succulent winter feed, and offers insurance for the farmer against short pastures due to summer drought and other crop losses. At present, according to figures released by Visking Co.'s Plastics Div., about 46% of the nation's 602,000 dairy farms have silos. It is estimated that from 20,000 to 25,000 conventional vertical silos are built per year and about 1200 new horizontal silos.

Research by the Purdue scientists with polyethylene film indicates that the chemically inert plastic material is not affected by the fermentation process, silage juices, or chemicals involved in the making of silage. While restraining the sun's rays from penetrating the stack, black film also keeps frost from silage.

Based on their research with the plastic film silos, the Purdue investigators recommend the selection of a cleared, well drained area on which to lay out the dimensions of the stack. Allowing 1 ft. of plastic film on each side for burial in the trench, a 20 ft. width of the film will cover an 11½ ft. wide stack 6 ft. high, with a capacity of 0.85 ton of silage per foot of stack length. A 24- by 100-ft. polyethylene tarpaulin will enclose 1.1 tons/ft. of stack length. Two men can easily cover an average stack (20 by 100 ft. in size) which will contain approximately 80 tons of grass silage. Approximate cost per sq. ft. of the 6-mil film, based on specially folded 24-ft. rolls 100 ft. in length, is three cents; for the 4-mil film, also available, the cost is just over two cents.

Since silage manufacture is a fermentation

Mulches and row covers

Black polyethylene mulch rolled over plants is slit and plants pulled through openings. (Photo, Gering Products)





Polyethylene mulch with aeration holes is one of several available. Others include plain film, film with die-cut holes for planting of seedlings, printed mulch, etc. (Photo, Monsanto Chemical)

At University of Kentucky Experimental Station, polyethylene row covers are used for earlier crop starts. (Photo, Spencer Chemical)



process and since uncovered silage can have its preserving acids leeched away by rain, even silage in standard structural silos must be closely covered. This is sometimes done with vinyl or polyethylene film and sometimes with a flexible polyester-fibrous glass "cap" which rests on top of the silage in the cylindrical tank. This retains nutrients and discourages mold growth.

In all silo work where vinyl is used instead of polyethylene, the best results are obtained with specific formulations, according to Dr. W. A. Cowan of the University of Connecticut. When used for steam sterilization of soil, the film must be resistant to the effects of steam vapor and moisture so that the plastic can be used over a reasonable period of time. In soil fumigation by chemical agents such as methyl bromide, gas-proofness of the film is necessary so that the fumigant will remain in contact with the soil during the normal 24 to 28 hr. exposure period. This technique is used in treating tobacco beds, compost heaps, pre-planting sites, greenhouse top soil, and propagation beds to increase crop yields, control weeds, and eliminate soil pests and soil disease organisms.

Mulches and row covers

Some of the most complete experimental work on plastic films for mulching and related applications has been carried out at the University of Kentucky Agricultural Experiment Station under the direction of Dr. E. M. Emmert, professor of horticulture. Dr. Emmert reports that black polyethylene film is the cheapest and most efficient mulch he has found in years of investigation. One of his projects, conducted under a research grant from Bakelite Co., involved a garden where mulching tests were run simultaneously on 13 vegetables. They were planted in a 60 by 125 ft. plot, of which half was mulched with 3-ft. wide strips of polyethylene.

Cost of the 1½-mil film ran about ¾ cents per sq. foot. The same number of seeds and plants were used on both sides of the plot. No

Five kinds of silos



Polyethylene loaf silo, or fermentation chamber, developed at Agricultural Development Station at Purdue. (Photo, Visking)



Reinforced plastics silo roof cap permits filtered sunlight to enter silo. (Photo, Marietta Concrete)



Polyethylene film used as silo cap in standard silo makes air-tight seal. (Photo, Visking)

weeding was necessary on the mulched side, but weeds grew so heavily on the unmulched section that frequent weeding was required between rows. In general, the test showed that vegetables on the mulched side ripened earlier and were larger than the unmulched vegetables. Yields on early ripening crops were up to four times as great on the mulched half. In the early spring, when the film was not shaded by foliage, soil temperatures under the mulch ran as much as 20° higher than those of the bare ground. Premium prices obtained on early ripening vegetables, according to Dr. Emmert, offset the cost of the film before the season was half over.

Striking results were obtained with many crops. Total yield of potatoes in this test was 250 lb. on the covered side against 150 on the bare ground. Total weight of cucumbers on the mulch was 80 lb. compared to 24 on the unmulched ground. More than 6 lb. of Kentucky Wonder beans had been picked on the mulched side two weeks before any were ripe on the unmulched side.

Other experiments conducted by Dr. Emmert have shown that plastics film row covers extend the growing season for top quality lettuce and tomatoes two months earlier into the spring and two months later into the fall. For covering a single row he uses 36-in. wide polyethylene film supported by No. 12 galvanized wire; for placing several rows under one cover, film 44 to 56 in. wide is used. Wire wickets are spaced about 2½ ft. apart. For best results, two layers of film are placed over the wickets to provide an insulating layer of dead air space above the plants.

Similar favorable results with plastics film mulches are reported from other sections of the country. In Southern California, strawberry growers are using rolls of polyethylene film to keep ripening berries from contacting moist ground; the resulting reduction in mold rot and disease, in effect, increases the marketable yield by one-third. When irrigation is necessary, small slits cut in the film allow water and fertilizer to penetrate to the plant (*To page* 199)



Walk-in silo lined with vinyl sheeting is a relatively permanent structure. (Photo, Monsanto Chemical Co.)



Trench silo of polyethylene of the type that has been developed by National Dairy Products Corp. (Photo, Visking)

Missiles' needs in plastics

New defense requirements demand a research break-through in structural and heat-resistant materials

By Carl R. Lemons

The purpose of this report is to stress the need for improving the strength of reinforced plastic materials to a point of suitability for missile airframe structures requirements.

The types of missile structures to which this discussion is directed are the large-size, long-range, high-velocity classes which are assuming predominance in missiles design today and which are bringing about a concerted materials improvement effort in the fields of plastics, metallurgy, ceramics, and others.

It may seem natural in some quarters that metals would be considered for these new designs, inasmuch as most of the current successful production missiles are of metal construction. However, the temperature requirements of missile design have exceeded the capability of most metals and it now becomes necessary to either insulate the metal structure from the heat source or to use a material combining high structural integrity with adequate insulative properties as one component. Reinforced plastics are among the materials which fit into the category of "insulative structure." The low thermal conductivity of reinforced plastics would allow the surface of the component to suffer the extreme high temperature exposure without exceeding the mechanical properties temperature limit of the load-carrying interior portion of the laminate.

Aerodynamic heating of missile structure is generally notable for this extreme transient character. Even an intercontinental ballistic missile (I.C.B.M.) must only withstand severe heating for a matter of minutes. Hence, in coping with aerodynamic heating, avenues are open to the missile designer which might be unacceptable for conventional aircraft use.

The temperatures considered in this discussion are in the order of 1500 to 5000° F. and it is obvious that if the exposure time at such temperatures is prolonged it is necessary to add more laminate thickness for heat protection. When this factor is applied to existing materials for the exposure time and temperature requirement of the missile, the weight of such a construction becomes prohibitive. Today there are no known materials or constructions—metals, ceramics, or plastics—which completely satisfy the weight and structural requirements of missiles on the drawing boards. The trend is to explore the materials of greatest potential strength increase, those materials which today may be marginal in current usage, but which have shown exceptional efficiency increase, given a certain amount of research effort. When this approach is applied to reinforced plastics we can prove that appreciable progress has been made over the last few years with a research effort almost negligible when compared to other ma-

The author



CARL R. LEMONS, Plastics Engineer, Douglas Aircraft Co., Inc., Santa Monica, Calif. was born in Memphis, Texas, in 1920. He attended Santa Ana Junior College, Santa Ana, Calif. and John Brown University, Siloam Springs, Ark., graduating in 1942. In 1943, he joined Douglas Aircraft. Between 1945 and 1947 he was plastics engineer for Zenith Plastics Co., Los Angeles. He rejoined Douglas Aircraft at Santa Monica, in his present capacity as head of the Plastics Section in Materials Research and Process Engineering. He is a Douglas Member of S.P.I. and has been the Douglas representative on several Aircraft Industries Association Committees concerned with plastic materials evaluation. Mr. Lemons has had close association with the materials problems on aircraft and missile plastic components designed by the Santa Monica Div. of Douglas over the past ten years.

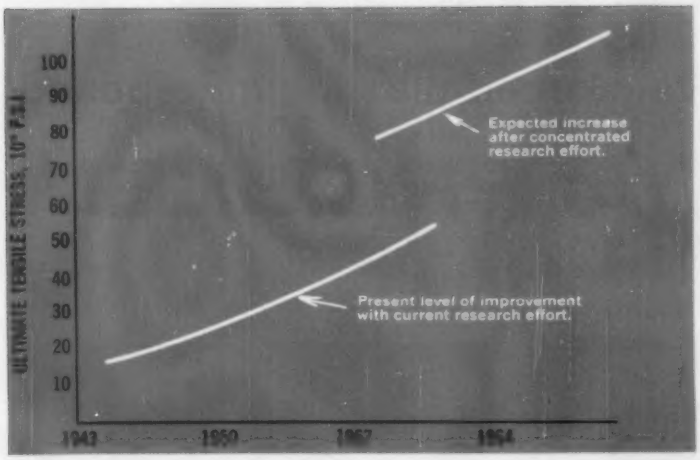


Fig. 1: Gradual improvement in fibrous glass laminate bi-directional strength at 500° F., using best resin binder system available in years noted. Slope of curve could also be applied generally to all strength properties combined to exemplify degree of improvement with time

terials development programs such as synthetic rubber or the enormous metallurgical research effort.

Figure 1 graphically illustrates the strength progress made by reinforced plastics over the last several years and indicates the magnitude of the increase needed to adquately satisfy the missile structure requirements.

One example of the type of test and resultant properties at high temperature may be illustrated by Fig. 2. This type of test is now being performed by means of quartz heating lamps (General Electric Type T-3, 500 w.) where energy input can be controlled more accurately than with open flame- or blow torch-type heating. The plastic specimen is given a certain load then subjected to a high temperature, e.g., 3000° F. on one surface until rupture occurs. After a series of loading conditions, a curve (1) may be drawn through the rupture points. If a thickness of specially designed insulation is applied to the surface of the specimen, curve (2) may be obtained. The thickness of insulation has been disregarded in this strength computation in order to compare the effect of temperature lag directly. However, the insulation addition soon reaches a point of diminishing returns if weight is considered. Therefore, new materials research is needed to obtain curve (3) where the insulation is also structural.

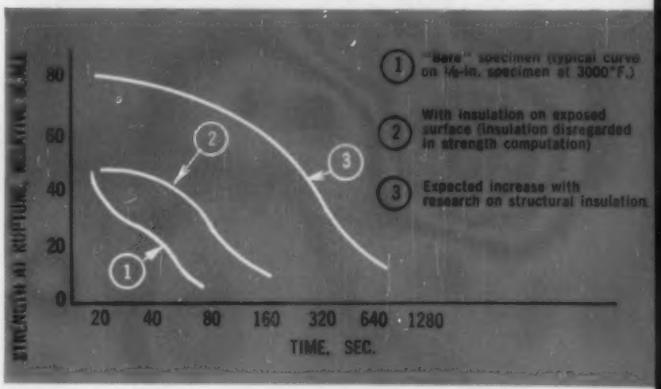
The shape of the curve in Fig. 1 may also apply to the modulus of elasticity; however, this property in reinforced plastics (3.5 to 5.0 $\times$ 10^6 p.s.i.) is so much lower than in most metals (10 to 30 $\times$ 10^6 p.s.i.) that it deserves special attention.

The low modulus of elasticity of reinforced plastic continues to plague the missiles designer just as severely as the property has complicated aircraft component designs for many years. The low stiffness factors will require the utmost effort in construction design ingenuity to prevent the associated weight penalty from offsetting the many advantages of reinforced plastics. Even though the specific tensile strength may be superior to a metal construction, the reinforced plastic component may fail through divergence or instability as a result of the excessive deflection.

New resin binders needed

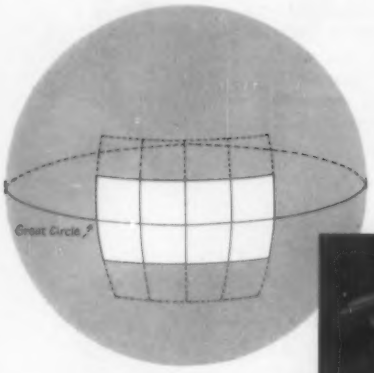
There have been significant improvements in modulus and in flame resistance as a result of using fibrous materials which have not been exploited for lack of application in aircraft, but which have been re-examined and are found unique to the new missile requirements. Along the same line, we have re-examined experimental resins "on the shelf" for possible application; however, it is unlikely that the strength increase desired in reinforced plastics will be achieved through some slight modification of existing materials. An entirely (*To page* 201)

Fig. 2: Results of typical tests for high temperature properties. Plastic specimen is given a certain load, then subjected to 3000° F. on one surface until rupture occurs



Reinforced plastics map posed

A PROBLEM





Portion of reinforced plastics map of South America (right) mosaicked on an eight-section unit, as exhibited by U. S. Army Corps of Engineers. Diagram above represents the Earth, with the area covered by the map at right outlined in solid lines. Dashed lines indicate the manner of projecting adjacent units. (Photos, Official U. S. Army)

An experimental project to duplicate the curved surface of the earth was undertaken by the U. S. Army Corps of Engineers. The purpose was to investigate simple solutions in mapping on large-diameter surfaces, and the result was a 10- by 20-ft. geometrical section of a sphere, on which was mosaicked a portion of a map of South America.

In addition to the size of the relief modeling work, the accuracy obtained and the fabrication methods present many interesting aspects.

The following specifications were established by the Map Compilation Branch of the U. S. Army Corps of Engineers' Research and Development Laboratories, Fort Belvoir, Va., and the Model Shop of the Laboratories was delegated to engineer and construct the spherical sections within these limits:

*Chief, Model Shop, U.S. Army Engineer Research & Development Laboratories, Corps of Engineers, Ft. Belvoir, Va.

One of the largest single entries at the Plastic Products Exhibition held at the Edgewater Beach Hotel, Chicago, Ill., was that submitted by the U.S. Army Corps of Engineers. The exhibition, sponsored by the Society of the Plastics Industry, was held in conjunction with the 12th Annual Technical and Management Conference, Reinforced Plastics Division.

1) *Geometry:* The sections were to be portions of a sphere of 250.835-in. radius. Three sides were to be great circles, each with an arc length of 65.669 inches. The fourth side was to be a small circle of 242.289-in. radius and arc length of 63.431 inches. All angles in this spherical quadrilateral are 90° and surface area is 29.608 square feet.

2) *Dimensional tolerances:*

IN GEOMETRY

*By S. B. Swenson**

(a) Variations in radii were not to exceed 1 part in 1000 (0.251 in.).[1]

(b) Variations in arc length of sides were not to exceed 0.05 in. of computed values.

(c) Variations in arc length of the diagonals were not to exceed 0.07 inches.

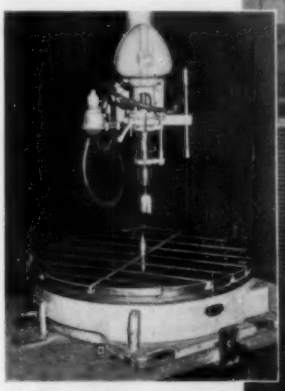
3) *Material:* The sections were to be constructed of reinforced polyester resin.

4) *Weight:* The sections were to be as light as possible commensurate with requirements of strength and accuracy and had to be capable of handling by one man.

5) *Joints:* Interlocking devices were to be designed for all edges of these sections so that they could be butt-joined. In addition, provision was to be made to fasten a second section onto the fourth side in the event a second section is built. At the joint the surface was to be continuous as possible with a maximum allowable interval of 0.03 in. between sections.

6) *Strength:* The sections, single and when

[1]Although the earth is normally considered an oblate spheroid, its departure from true sphericity is so slight (less than one-third of one percent or 13.5 miles of its radius) that it would have no bearing on the required studies. In fact, variation from the greatest ocean depth to the greatest mountain height amounts to more than 12 miles—almost equal to the amount of the flattening at the poles.



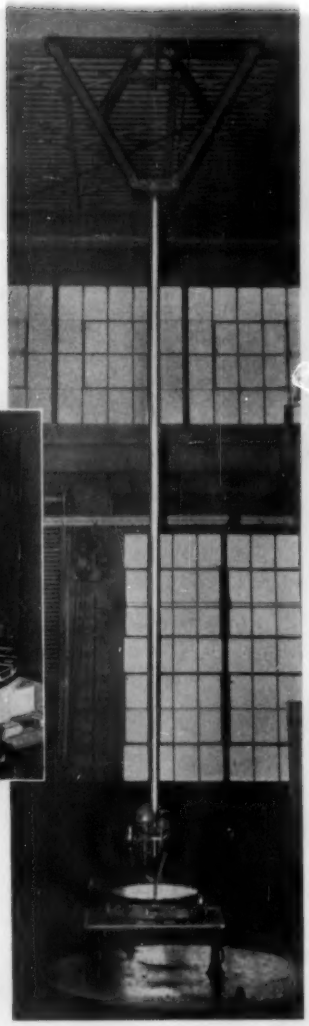


Fig. 1 (right): Special milling equipment with sweep of 250.835-in. radius for machining curvature required for master die

Fig. 2 (inset, above): Close-up of rotary table which turns plaster blank during milling. Three leveling jacks can be seen at bottom of photo at right



Fig. 3: Plaster blank precast over steel mesh armature on rotary table (see Fig. 2). Mold for master male die is developed on blank by passing cutter head slowly through its arc as table rotates

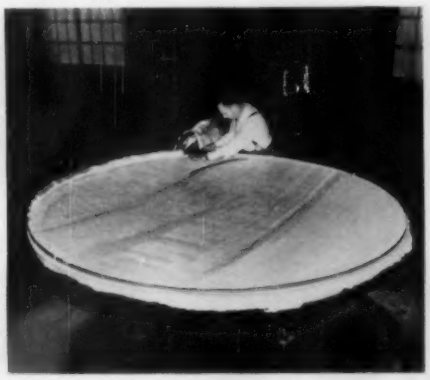


Fig. 4: Master male die is cast on milled plaster mold, using polyester resin and glass cloth reinforcement. Operator is shown trimming excess cloth

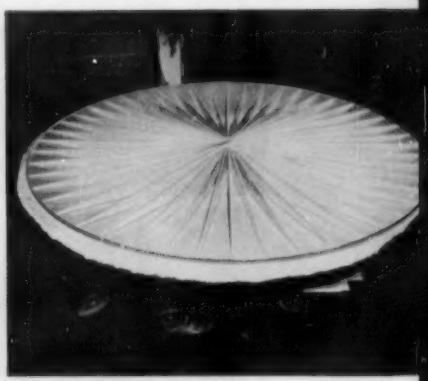


Fig. 5: radial bracings of polyester-glass sheet are cemented to master die with epoxy resin, help maintain precise curvature of die



Fig. 6: Finished laminate is removed from mold; next step is the attachment of framework



Fig. 7: Structural unit of framework, used for connecting adjoining sections, is attached to laminate

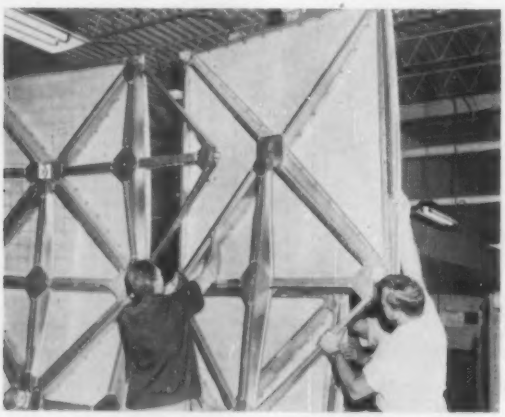


Fig. 8: Rear view of sections being assembled into finished map. Interlocking devices permit sections to be butt-joined

fastened together, were to be strong enough to support 150 lb. with negligible residual distortion.

7) *Surface:* The surface was to be a smooth matte finish capable of accepting an inked line or a pencil line 0.005 in. wide. The surface was to be colored to match the color of ocean areas of standard map sheets.

Sequence of operation

Briefly, the sequence of operations in producing these spherical sections is outlined as follows:

Due to the varying shapes that would be required to construct a complete sphere, it was decided to construct a master spherical surface from which could be made molds of whatever shape necessary.

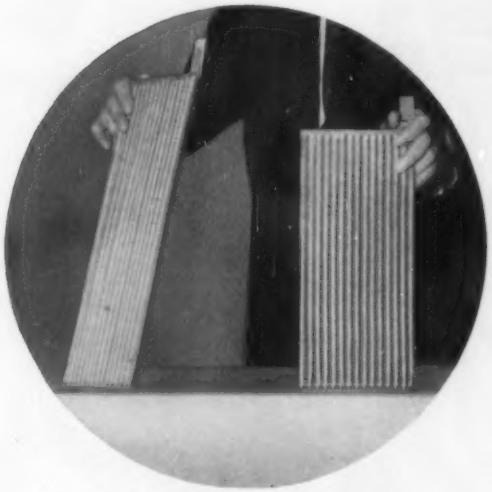
A special set-up of milling equipment (Fig. 1), providing a sweep of 250.835-in. radius, was necessary to machine the curvature required for the master male die. A fixture fitted with a universal joint was hung on a ceiling beam of the shop building to support a length of shaft on which was arranged a drill head which could be adjusted to the proper radial length of the sweep. The radius was measured from the pivot point of the universal joint to the cutting edge of a carbide tipped rotary cutter in the chuck of the drill press head. A rotary table (Fig. 2), resting on three leveling jacks was provided to turn the plaster blank in the milling operation, while an improvised cable and winch arrangement served to furnish the cross-fed action required on the sweep.

The plaster blank was precast over a steel mesh armature on the rotary table (Fig. 3), and the mold form was developed on this precast slab by passing the cutter head slowly through its arc over the rotating table.

The master male die was cast on this plaster mold using polyester resin and fibrous glass cloth (Fig. 4). A ⅜-in. cellular cellulose acetate core was used between the facing laminate and backing laminate to obtain maximum stiffness. To gain further support to the curvature of the die, radial bracings of polyester-glass sheet were cemented in place using epoxy adhesive resin (Fig. 5). A backing sheet or membrane of polyester glass laminate was cemented over the entire assembly to form a unit.

Concave mold constructed

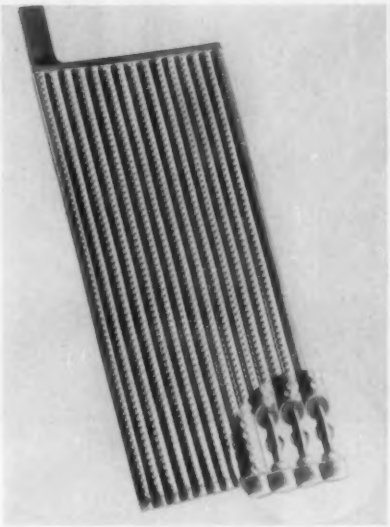
From this completed male master die the first concave mold was constructed by setting up four aluminum sides or retaining (*To page* 206)



Better battery

Rigid vinyl and braided glass combine to give battery plates longer life, provide 40% more power

Two positive plates for same size battery case. Plate at left uses glass-lined vinyl sleeve, plate at right slotted polyethylene. The lined vinyl sleeve cuts down sedimentation, thereby reducing sedimentation space needs and making possible longer plates. (Photos, Exide Industrial Div.)



Close-up of plate with cut-away view of unplasticized vinyl sleeve. Seals at bottom are polyethylene

Power requirements of industrial trucks can now be met more efficiently because of the introduction of braided glass-lined unplasticized polyvinyl chloride sleeves to hold the active material and grid spines of the positive plates in TG Ironclad storage batteries.

This development was announced by Exide Industrial Div., The Electric Storage Battery Co. a year after the company had replaced rubber sleeves with slotted polyethylene tubing for the same purpose (see MODERN PLASTICS 33, 199, March 1956). The polyethylene sleeve was credited with increasing battery service life by about 20 percent. The switch to vinyl has lengthened that life span still more and at the same time has made possible units that can provide up to 40% more power without an increase in battery size.

The vinyl sleeve is produced from calendered film 0.016 in. thick. Strips of film are punched with small-diameter holes spaced in a close staggered pattern. The punched strips are then mechanically formed into tubes 3/8 in. in diameter. Fitted inside the tube is a sleeve consisting of braided glass monofilaments.

This construction has an important bearing on the performance of the battery.

First, use of vinyl permits a reduction in wall thickness of the sleeve. This allows more active material to be used for a given volume of battery. Second, the oxidation resistance of unplasticized p.v.c. assures long service life. Third, the vinyl sleeve with its many openings, and the highly porous glass liner assures ready diffusion of the electrolyte.

Finally, the glass liner, while permitting diffusion, reduces sedimentation to practically zero. Thus, only a small sedimentation space is necessary at the bottom of the battery case, permitting use of longer elements.

Credits: Vinyl from a number of domestic sources; calendering and fabricating now contracted out, but Exide plans to go into this activity soon.



6000

Interior view of rotary vacuum filter in the Metropolitan Sanitary District of Greater Chicago for converting domestic and trade wastes into fertilizer. Plastic pipes carry ferric chloride used in the conversion process. (For details of installation see p. 102)

A valve was turned in West Texas early last month and natural gas surged into a new pipeline. It is the latest addition to a network of small-diameter, "personal" pipelines that carry gas to fuel irrigation pumps on farms. In Texas, home of the Big and Little Inches, it probably didn't stir up much of a fuss when it went into operation. But it did get attention at U. S. Rubber's Naugatuck Chemical Division; for the line is all plastic, and somewhere along its length is the 6000th mile of pipe made from Naugatuck Chemical's ABS polymer blend, Kralastic.

In addition to hitting the 6000-mile mark, Kralastic pipe will also have its tenth birthday this year. This age — regarded as almost ancient in the United States where plastic pipe is still considered relatively new — plus its multi-thousand mile use record, make it one of the leaders in the rigid plastic pipe field.

Biggest use for the pipe is carrying natural gas. More than a third of all the miles made from the material is being put to this use. But it is far from a single-use pipe. When considered from a poundage standpoint, as contrasted with miles, more of the material is used in oil field pipe to transport salt water and crude oil. The pipe also hauls fruit juices, irrigation water, laundry cleaning compounds, battery acids, photographic developing fluids, water purifying chemicals, sewage wastes, and leather tanning chemicals.

Pipe has interesting properties

A combination of physical properties has led to these many uses. First, the pipe is stiff and can be easily handled in lengths up to 30 ft.; it is light — only one-seventh the weight of steel; it has good corrosion resistance; and is unaffected by a long list of materials including chlorine, alcohol, and gasoline. It is rugged, with high impact and tensile strength. It can be threaded, or solvent-welded.

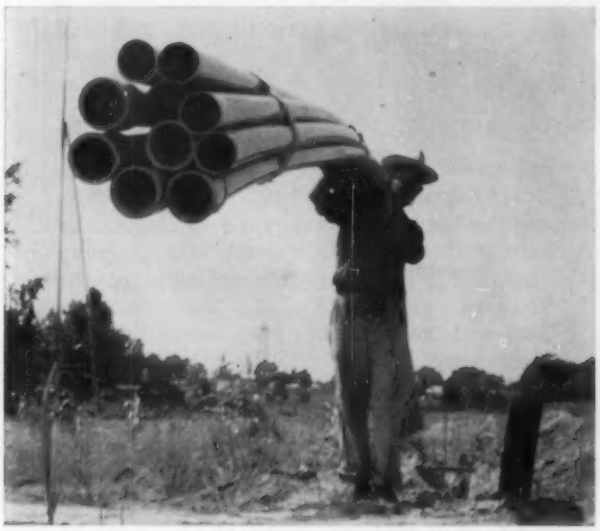
Extruders and compounders list maximum operating temperature of the material at 170° F., highest of plastics in broad use for pipe. They

*Vice president and general manager, Naugatuck Chemical Div., United States Rubber.

miles of pipe

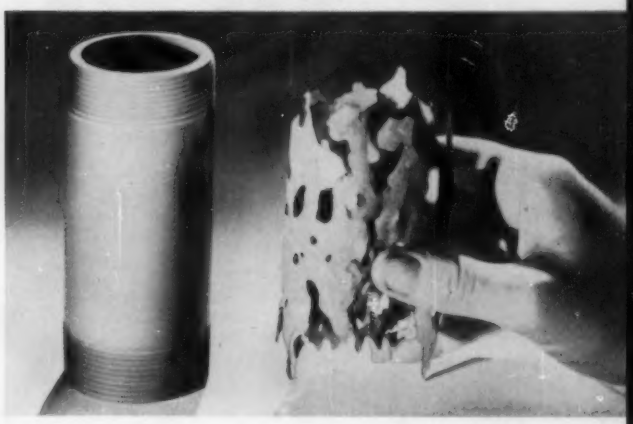
How and why a rubber-resin blend has made good in the rigid plastic pipe field

*By George R. Vila**



Workman carries 300 ft. of pipe for use in a salt water disposal system in a Mississippi oil field. Pipe was extruded by Southwestern Plastic Pipe Co. Weight of the 300 ft. is approximately 75 pounds

Section of resin-rubber pipe (left, below), used in piping sulfuric acid in demineralizer, is unaffected by action of chemical. At right is piece of 2-in. stainless steel pipe used for same purpose over comparable period



give its room-temperature tensile strength as 5000 p.s.i. Its notched Izod impact strength at room temperature is listed at 5 ft.-lb./in. of notch. They also say its low specific gravity of 1.06 means more feet of pipe per pound. And they further claim it can be extruded at high rates.

Natural gas powers pumps

West Texas, where the latest plastic pipeline was laid, is only a few minutes by airliner from the famous drought belt that starts in southwest Texas and sweeps up into some of the western states. By contrast, West Texas has water flowing deep below its surface and can draw this water up to irrigate its farm lands.

Getting water to the surface, however, requires a good deal of equipment—pumps and fuel for the pumps.

About five years ago a group of farmers bent on cutting fuel costs formed a cooperative and built a feeder pipeline from a main natural gas line to haul gas to pumps on their farms. The idea spread through such farming counties as Hale, Lubbock, Swisher, Deaf Smith, and Lamb. More cooperatives were formed, and as gas companies extended their main lines into the area more feeder lines were built. Today a jagged network of feeder lines fans out from the main gas lines all the way into the farming district.

Most of these feeder lines are plastic, and farmers have gone to plastic because — like natural gas — it is economical. The biggest of the co-op lines linking about 250 farm irrigation pumps in Swisher and Castro counties to a main gas line, is 150 miles long. A small work crew installed it in about 45 working days, using 30-ft. lengths of pipe and solvent-cementing them together.

All told, more than 2800 miles of Kralastic pipe are now in use in West Texas, probably



Natural-gas pipeline is ditched in irrigated farming section of West Texas. Pipe was extruded by Republic Steel Co. from resin-rubber blend. (Photo, U. S. Rubber Co.)



Fittings molded of Kralastic material. In order to assure a leak-free joint, these fittings are produced with sockets that are slightly smaller than the pipe fitted into them. When a joint is made during installation, a thin layer of the inside socket wall is dissolved with solvent cement and the pipe pushed snugly into place. High contact pressure between fitting and pipe then brings about a leak-free cemented joint

qualifying the area as having the largest concentration of plastic pipe in the country. All of the pipe is thin-walled, most of it is 2 in. in diameter, and all of it operates on pressures that start with 50 p.s.i. at the main. Beyond a few leaky joints (resulting from faulty welds) there have been no reports of failures.

Many uses in oil fields

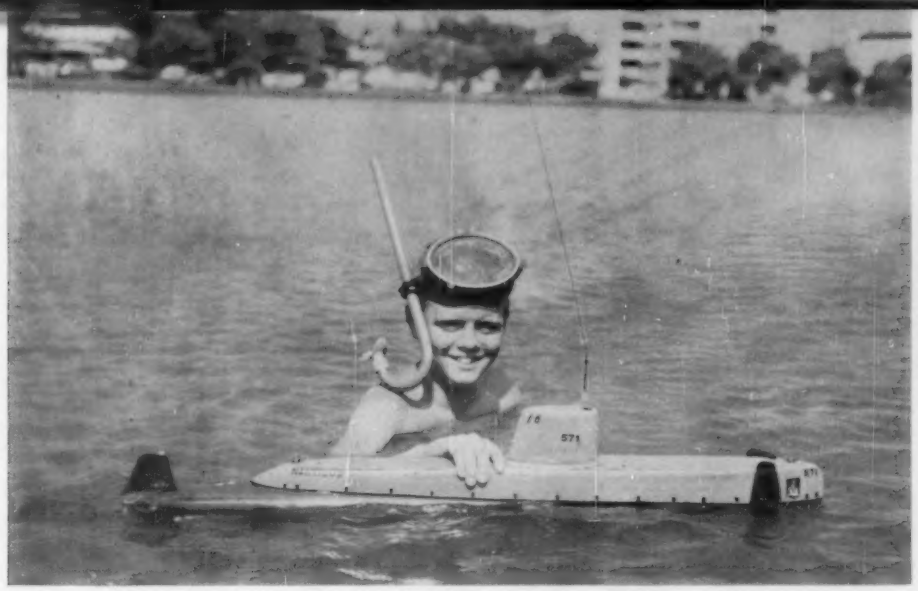
In the oil country of Texas a short stretch of pipe made from Kralastic has been getting constant abuse for the past four years, and is still performing well. The line is used in salt water disposal. But this is a vacuum system, and the line operates under a 20- to 28-in. vacuum at 110° F. Another plastic was originally used, but it collapsed after six weeks of use. The pipe made from Kralastic was installed in 1953, and there has still been no need for replacement of it.

Corrosive crude oils are also being swirled through Kralastic pipe in some fields. One line, about a half mile in length, replaced a metal line after the highly corrosive oil ate away sections of the metal pipe in four months. The line is now in its fifth year of use, and there are no signs of corrosion. However, the material is not yet recommended for handling crude oils with a high paraffin content. The paraffin builds up in the pipe, slowing the flow of oil.

Use of Kralastic pipe in chemical plants is on the increase. A Minnesota leather tanner uses the pipe to haul salt, sulfuric acid, alkali, hard water, and chrome liquor. It replaces metal pipe which had corroded and sprung leaks, and the plastic pipe has now been in trouble-free use for over two years. In a Washington paper mill such pipe has been carrying calcium hypochlorite bleach liquor for the past six years, without sign of a failure. In a sugar factory hydrochloric acid has been flowing through pipe made from the material for the past five years, and in that time not a length of the pipe has been replaced.

In sewage treatment

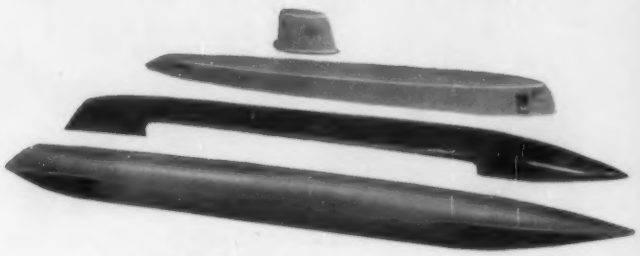
One of the oldest installations of pipe made from the material is in the world's largest sewage treatment plant, the Metropolitan Sanitary District of Greater Chicago. The installation, using Uscolite pipe compounded from Kralastic-type material by U. S. Rubber's Mechanical Goods Division, was started on (*To page* 203)



Hull (partly submerged) and superstructure of model submarine are vacuum formed of impact styrene sheet; antenna goes through acrylic snorkel tube into hull. (Photo, Am. Modeler)

Fabricated plastics sheet and tube form structure of

Radio-controlled model sub



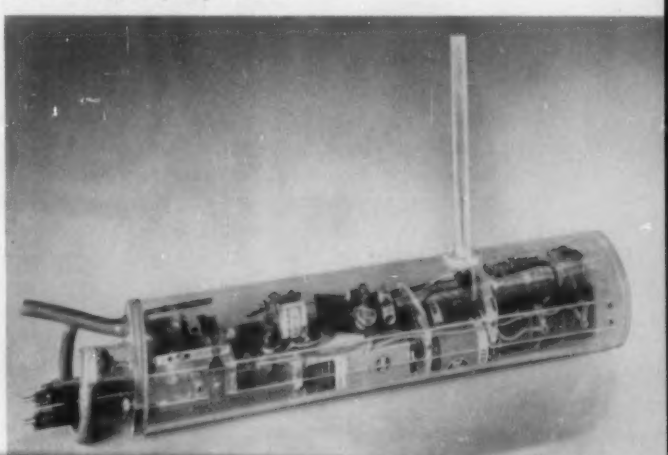
Conning tower, deck section, and two parts of hull are vacuum formed separately, later assembled into complete unit

Liberal use of plastics components and ingenious design of electronic circuitry have resulted in what is probably the first operative radio-controlled model submarine ever placed on the market. Developed by Reid Electronics, Asbury Park, N. J., and selling for about $150 in kit form at retail, this luxury item is aimed at the same market currently being served by motorized model airplanes, surface boats, and the like. It follows the firmly established trend of using formed styrene alloy sheet for all essential body components of such models.[1]

The craft — over 3 ft. long — can submerge and surface, execute right and left turns above and below water, and move forward and backward, all at the wireless command of the happy hobbyist standing on shore with his transmitter. (A radio-controlled mechanism for launching dummy "torpedoes" is being investigated for inclusion in later models.)

All exterior parts of the sub, including the hull (made in two parts, port (*To page* 205)

Cylindrical waterproof housing for operating parts of model sub is fabricated of acrylic sheet and tubing. Hose at left attaches to bag that controls buoyancy of craft



[1]For earlier examples of the use of vacuum formed parts for model toys, see the following articles in Modern Plastics: "Model speedboat vacuum formed" (May 1955, p. 88; "Formed styrene parts for model airplane kit" (November 1955, p. 133); "Plastics move into bluechip markets in toys" (January 1956, p. 107).

Atomic attack

Report presented at Midwestern Conference, Society of the Plastics Industry, June 13, 1957, Hot Springs, Arkansas, by the Chairman of the S.P.I. committee concerned, Harry Voskamp, Assistant Sales Manager, Barrett Div., Allied Chemical and Dye Corp. Information in this article was taken from S.P.I. records of the test and its results, and is in no way to be construed as being an official report of the Federal Civil Defense Administration or the Atomic Energy Commission. Official reports from these two agencies are yet to be released.



Over-all view of Station 1, 6600 ft. from ground zero, before detonation

What can happen to plastics used in building construction, in industrial components, in electrical devices and appliances, in transportation, and in other major areas of use when the locations of their use are subjected to atomic attack?

To answer this question, Project 31.5 was set up in Yucca Flats, Nev., as part of "Operation Cue" in the spring of 1955. It was a cooperative venture conducted under the auspices of the Society of The Plastics Industry, Inc. and involved plastics material producers, molders, processors, fabricators, extruders, and laminators. Offered for evaluation were 900 samples of plastics materials and products, a fairly complete cross-section of the materials that were then available.

Operation Cue, a multi-million dollar drama, had as it leading character an atom device labeled "Apple 2." This device roosted on a 500-ft.-high iron tower and a select audience occupied reserved spots on Media Hill, 7½ miles from Ground Zero. So many thrilling descriptions of atomic blasts have already been written that the awesome details need not be repeated in this article.

The purpose underlying Project 31.5 was to test and gather data on the thermal ignition and response of plastics materials under blast circumstances.

A central laboratory processed the test samples into 680 individual units, coding them in various ranges of thicknesses, colors, and types of materials. They included acrylics, cellophane, cellulose acetate, cellulose acetate butyrate, epoxy laminates, polyester laminates, high-

on plastics

pressure laminates, melamine, polyester film, nylon, phenolics, polystyrene, saran, unplasticized vinyls, plasticized vinyls, polyethylene, and others.

Every effort was made to make certain that materials submitted for evaluation represented those which now reach the consumer and industrial markets.

Scientific evaluations of data obtained on the plastics materials show that they possess excellent safety characteristics, which make them applicable to many consumer and industrial items for the protection of the individual and the family.



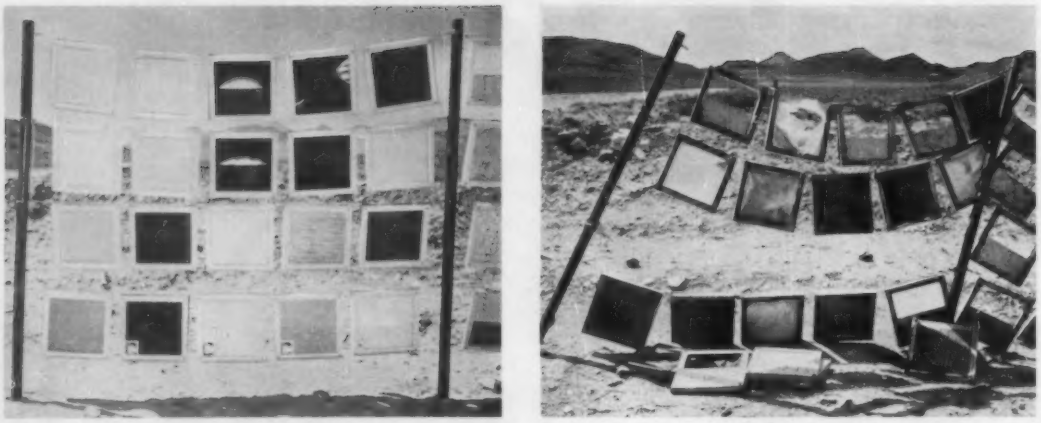
Appearance of Station 1 after explosion of nuclear device

Because of their shatterproof characteristics, certain plastics show promise as glazing and window-covering materials for both home and industrial buildings. Many lightweight, homogeneous film materials may provide unusual protection to the individual against exposure to radiation and fall-out. A countless array of applications already widely used by the consumer offers shatterproof and lightweight characteristics. These applications include dinnerware, bowls, utensils, and others; sections of laminated fire-resistant plastics in a wide range of thicknesses showed excellent safety characteristics.

Several materials, specially tailored for use in safety applications, were submitted to the Project 31.5 test program. The names of these materials are classified.

Experimental design

The 680 plastics units involved in the 31.5 Project were installed at three stations located at 6600, 7660, and 8690 ft. from Ground Zero. The film and elastomeric type materials were cut in 12- by 12-in. sizes and placed in test racks. Several ranges of thicknesses and colors of all types of materials were hung at each test station. Where possible, and if furnished by the company, a 12- by 12-in. sample of the same material was prepared for each station in order to obtain comparative results. The frames were strung on heavy-duty wire and held vertical



Station 1, Section 1, before (left) and after (right) detonation. First three rows, supported and unsupported vinyl film and sheeting; bottom row, acetate, except right-hand sample which is polyethylene

between 2½-in.-diameter iron pipe, facing Ground Zero.

There were 245 samples installed at Station 1; 221 at Station 2; and 214 at Station 3.

The test frames were so constructed that one-half of the test sample was exposed with no backing of wood; the other half with backing. The more rigid materials not placed into frames were completely exposed.

A wide variety of household applications, such as melamine dinnerware, polystyrene and polyethylene bowls, baskets, trays, etc. were placed in the houses constructed on the site.

No instrumentation was installed at the plastics site. Evaluations were visual.

The degree to which the three stations of plastics samples were influenced by the thermal effect of the device depended upon several factors: 1) Type of material; e.g., thermoplastic or thermosetting; 2) thickness of material; 3) color—a predominant factor in reaction; 4) the actual distance of the sample or samples from Ground Zero, or the energy received.

These, however, were not the only factors involved in evaluating the results of thermal exposure. For instance, the samples were installed at least ten days prior to detonation. During this period, the test site was subjected to high winds and the abrasive action of windblown dust, periodic rains, and high-heat conditions. These resulted in the ripping of some of the thinner samples and the warping (to a small degree) of some of the plastics panels.

Since all atomic devices do not behave in the same fashion as regards the production of blast energy and thermal radiation, and since the same type of atomic device can produce different effects depending on the weather, size of specimen being tested, location of samples, kind and quantity of samples, and flammable materials surrounding the test rack, conclusions must be applied with care and extended in a general way.

The evaluation of results from this thermal exposure is in no way all-inclusive, in that this was a "go—no go" test under field conditions.

In general, as might be expected, the thermoplastics were affected by the thermal radiation of the nuclear weapon more so than were the thermosetting plastics.

Following are general statements of the reaction to thermal heat of the families of plastics installed at the site:

Vinyls: In general, the vinyls showed more definite reaction to the heat than any of the other samples submitted. At Station 1 it was not unusual to find unsupported vinyl film in ranges of 0.004, 0.006, 0.008, and 0.012 in. completely melted, regardless of color or pattern. As might be expected, these same films were melted partially at Station 2. At Station 3 these materials were slightly fused. Those vinyl films at Station 3 in the range of 0.004 to 0.008 in. which were patterned and pigmented showed that dark designs against a white background were melted, while the background itself frequently remained intact.

Vinyl fabric laminates of supported upholstery in ranges of 0.025 to 0.028 in. remained intact at Station 1 but, in general, evidenced considerable surface burn. So did laminated vinyl-paper wall-covering materials.

Supported vinyl upholstery materials 0.020 to 0.030 in. remained intact in the test racks but exhibited surface burn or char.

Vinyl sheeting, both non-rigid and rigid, in a range of thicknesses 0.040 to 0.045 in. remained intact and undamaged at Section 1.

Unplasticized vinyl sheeting in 30 mil thickness melted partially at Station 1, but in 50 mil thickness remained intact with slight surface burn.

Saran filament: Materials woven of this composition melted completely at both Stations 1 and 2, with nearly complete melt at Station 3.

Teflon: In natural white and in thicknesses of 0.005 to 0.060 in. this material remained intact at Station 1.

Polyethylene: This material in natural white remained intact at Station 1 in thicknesses of 0.030, 0.090, and 0.500 inches. Thinner films of polyethylene, however, were completely melted at Stations 1 and 2, but remained intact at Station 3.

Molded nylon: This material in natural white in thicknesses of 0.250, 0.060, and 0.375 in. remained substantially unaffected and intact at Station 1.

High-pressure laminates: These laminates exhibited excellent resistance at all Stations, and in all thicknesses. A few of the samples did show a slight surface melt and char at Station 1.

High-styrene copolymer sheets: At Station 1, these samples remained intact with varying degrees of surface burn and char.

Acrylic sheets: The acrylics in thicknesses of 0.060 to 0.125 in. in white translucent, black, and colorless, remained intact at Station 1.

Cellulose acetate: This material in thicknesses of 0.080 in. in several colors remained intact at Station 1, with a slight surface char on an opaque black sample.

Cellulose acetate butyrate: Here again, a black sample 0.040 in. thick remained intact but showed a surface char at Station 1, while a clear sample 0.080 in. thick remained intact and perfect.

Polystyrene sheet: This material in thicknesses of 0.085 in. remained intact with no surface changes at Station 1.

Saran film: This material melted completely at Stations 1 and 2, but only partially at Station 3.

Nylon film: These samples in 0.020-in. thickness remained perfect at Station 1; a 0.009-in. sample melted partially, while a 0.005-in. sample melted completely.

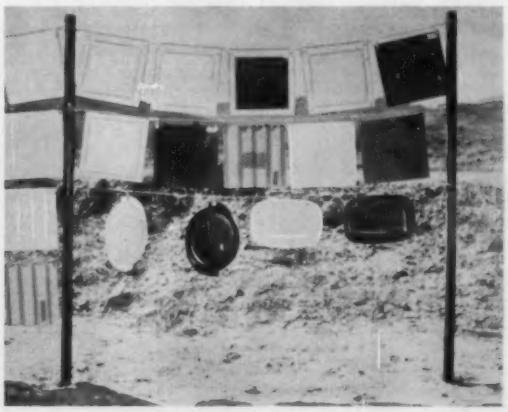
Pipe: Several sections of commercially produced plastics pipe were submitted to all three Stations. In general, pipe remained undistorted regardless of the type material. At Station 1, the side of all pipe facing Ground Zero charred appreciably with a lessening surface change at each of the other two Stations.

Molded phenolic pieces: These pieces were glass-filled, tire cord-filled, fabric-filled, and asbestos-filled. All remained substantially unaffected and undamaged at Station 1.

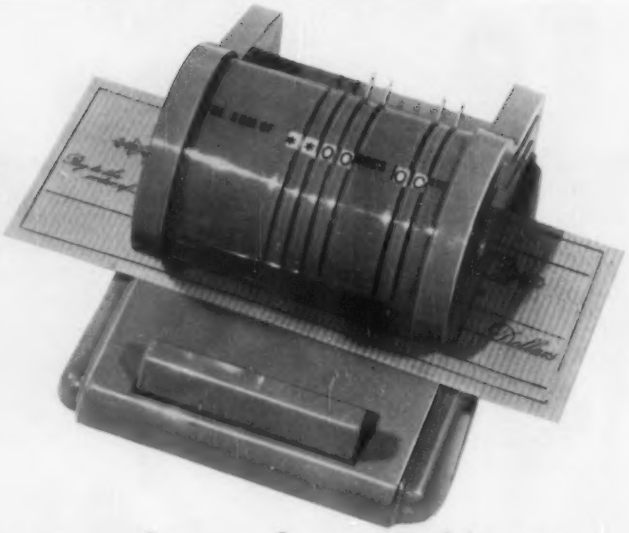
Polyester molded parts (premix compounds): These parts remained unaffected at all three Stations.

Reinforced plastics corrugated and flat laminates (polyester resin with fibrous glass filler): These materials, in all shades (*To page* 208)

Station 1, Section 12, before (left) and after (right) detonation. First two rows, high-pressure laminates, except center second row which is polyester-glass; bottom row, dinnerware plates



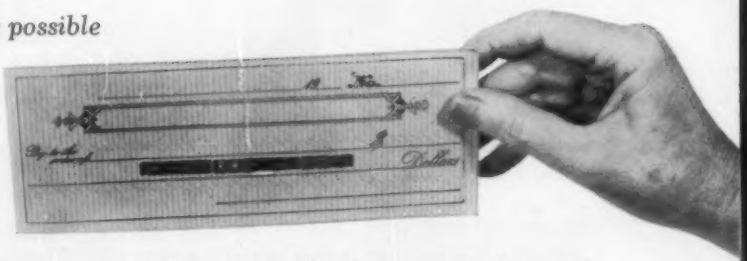




Sturdy all-plastics check printer, made up of molded impact styrene and acetate sheet parts, accommodates all check sizes and styles. (Photos, Catalin Corp. of America)

All-plastics check writer

Ingeniously designed styrene and acetate components simplify assembly, make possible easily operated instrument



The office equipment field, long a fertile market for plastics materials, has yielded another new and unique application: an all-plastics portable check writer assembled of molded high-impact styrene and acetate sheet parts. Designated PermaPrint and marketed by Applied Research Corp., Erie, Pa., the instrument — which "writes" permanently tamperproof checks — is made to retail for about $29.50 and is expected to sell at a rate of about 30,000 units per year.

This estimate may appear high; but in view of the properties that have been built into the machine, it is not unreasonable.

One of them is price. At less than $30, it sells for about half the cost of equivalent metal counterparts. Other factors that combine to make the PermaPrint an outstanding product include the following:

1) Compactness. Although only 5 in. wide, 4 in. high, and 7 in. long, the machine will accommodate all bank check sizes and styles.

2) Integral color. The unit is made in a range of hues to harmonize with modern office decor. Colors are molded in, cannot wear or chip off.

3) Ease and reliability of operation. Practically all operating parts are made of plastics molded to close-tolerance specifications and working by direct mechanical action. Maintenance is negligible.

4) Strength. Made of tough impact styrene and acetate, the unit is sturdily constructed to withstand the rigors of normal office use.

These factors, together with its pleasing overall appearance, assure the equipment a hearty welcome in business offices; they also make it a likely candidate in homes for personal use.

Complex parts, easy operation

The various plastics that go into the check writer are shown in the accompanying photographs and are identified in the table opposite. Respective weights and molding cycles are also listed in the table.

As is readily apparent from the photos, these parts are designed with great ingenuity. Molded-in grooves, cores, holes, bosses, etc., make it extremely easy to assemble the finished unit, using a minimum of fastening devices. As is characteristic of good plastics design, complex molds and moldings are utilized to provide simplicity of operation.

Printing numerals and characters, made from a special rubber compound, are mounted on

prongs molded into each dial. These numerals are constructed with microscopic honeycombed cells that hold the necessary ink supply. Indicating numerals, molded into the dials and spray-painted black for legibility, appear through the clear "windows" in the acetate drum and correspond to the rubber numerals that do the actual printing. The drum itself fits grooves molded into the end caps.

Fastened to each dial by means of molded-in rivets is a metal lever with which the dials can be set to register the desired amount. The levers protrude through slits machined into the drum. The dials rotate around a metal shaft that runs through molded-in openings in the three block holders and is seated in molded-in sockets at the inside of each end cap. The block holders, which separate the dials into groups of two and four, straddle the two detent bars and provide pressure for the coil spring-loaded ball bearings in the lower detent bar. The function of the bearings is to furnish stops for the dials by engaging rectangular molded-in indexing depressions as the dials are rotated. An audible click indicates the completion of indexing.

Once the desired amount is set, the printer bar is depressed, pushing the face of the check against the rubber numerals and imprinting the amount. The ink at the same time penetrates through the thickness of the check, making it tamperproof. Up to 10,000 checks can be written before an ink refill is necessary.

Credits: All styrene parts molded by Quinn-Berry Corp., Erie, Pa., on 8-oz. Lester-Phoenix injection machines, using high-impact polystyrene supplied by Catalin Corp. of America, New York, N. Y. Drum fabricated by Fabri-Kal Corp., Kalamazoo, Mich., from 0.0525-in. Kodapak acetate sheet supplied by Eastman Chemical Corp., New York, N. Y.



Component parts of check writer; letters on parts link to designations in table below

Components of PermaPrint check writer

Part[a]	Designation	Weight	Mold	Cycle
		g.		sec.
A	Drum[b]	31	—	—
B	Right end cap	41.6[c]	Family	60
C	Left end cap	42.7[c]		
D	Base[d]	99.5		
E	Small block holders, each	2.7	Family	36
F	Large block holder	7.3		
G	Detent bar, upper half	3.9		
H	Detent bar, lower half	4.7		
I	Printer bar	23.7		
J	Dials, each	9	six-cavity	36

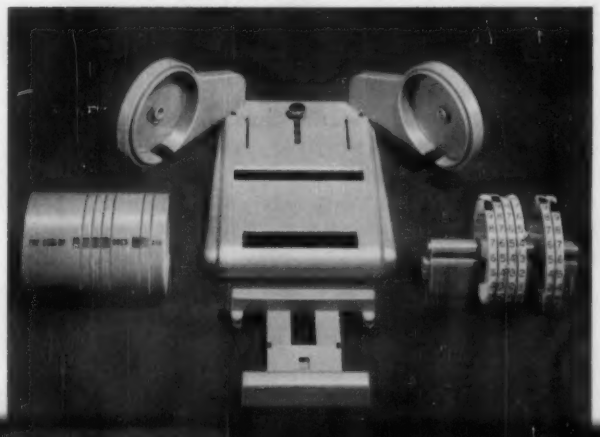
[a]Letters refer to parts shown in photo above.

[b]The drum is fabricated from acetate sheet. The cylindrical form is obtained by placing the heated sheet over a mandrel. Legends are silk-screened on and the sheet is then second-surface spray-painted in a color to match the molded styrene pieces.

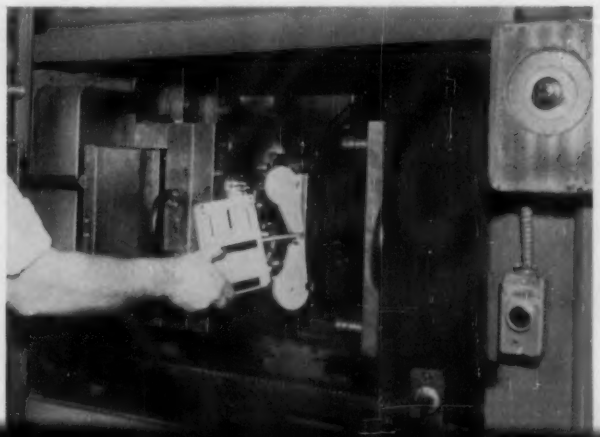
[c]Although the right and left end cap appear to be identical, there is a slight difference in the height of the shaft sockets (see photo left below) and in the section of the pieces, which accounts for the 0.9-g. difference in weight.

[d]A metal plate (not shown in photos) is attached to the underside of the base for greater stability.

Sub-assembled unit. Drum at left is fabricated of acetate sheet. All other parts are molded of high-impact styrene



Operator removes shot of base and two end caps from family mold. (Photo, Quinn-Berry Corp.)



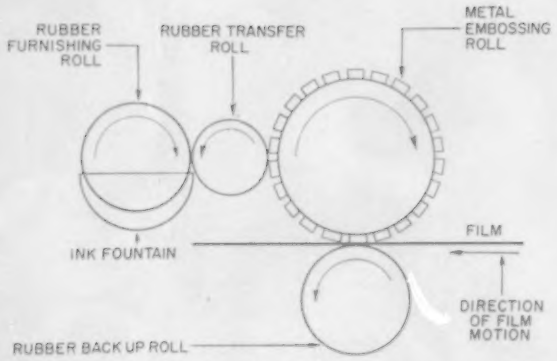
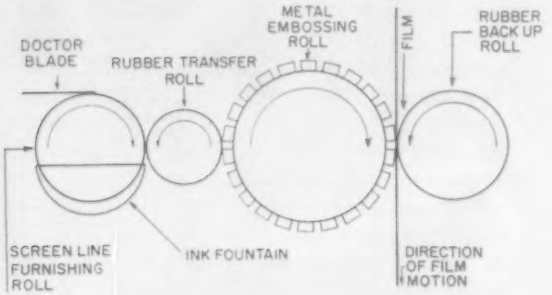


Fig. 1: Poor ink feed control

Fig. 2: Crowning of embossing roll and poor ink feed control



Valley printing on film

Plastics converters, assisted by printing press manufacturers and ink suppliers, have developed methods of producing three-dimensional printed effects on plastics

*By Hal-Curtis Felsher**

Rapid inroads of decorative vinyl and polyethylene fabrics into the textile market are being made possible by recent advances in embossing and printing techniques. It was early recognized that the design potential of these thermoplastics could be greatly expanded by the development of three-dimensional printing. Searching for new markets, plastics converters are gradually perfecting the valley printing technique, assisted in large part by printing press manufacturers and ink suppliers.

Valley printing is, in most respects, identical with flexographic printing. In a valley printing press, a rubber inking roller supplies ink to a metal printing roll. The metal roll is an embossing roll which simultaneously forces impressions into pre-heated plastic film and deposits ink in the same impressions. The result is a fabric with a three-dimensional printed design.

The first commercial attempts at valley printing were moderately successful, but only on limited yardage. It quickly became evident, however, that profitable valley printing could result only by perfection of machine design, embossing roll design, and ink formulation.

Some of the first valley printing machines were built simply by adding two-roll printing heads to existing embossing equipment, as shown schematically in Figs. 1 and 2. It was found in some cases, however, that sufficient pressure on the embossing roll to produce satisfactory embossing caused, in specific arrangements, a crown on the roll which prevented uniform inking. It was also found that neither the two-rubber-roll head nor the combination screen roll and rubber roll head arranged horizontally provided the precise control of ink feed required by the process. Modifications shown in Figs. 3 and 4 gave considerably improved results.

Development of satisfactory ink formulations paralleled the evolution in machine design. Because heated equipment is required for valley printing, ink manufacturers regarded elimination of the fire hazard as a necessity. This led, logically, to the development of water-based inks.

But our research people considered this ap-

*Technical director, Claremont Pigment Dispersion Corp., Roslyn Heights, N. Y.

proach fundamentally unworkable. Over long runs, it was found that these inks tended to build up deposits on the embossing and furnishing rolls which could be removed only by hand scrubbing. The result was poor print definition, flooding of the pattern in some instances, uncertain adhesion of ink to plastic, and costly shutdowns.

It then became clear that only solvent-based inks would provide all of the working qualities required to obtain satisfactory valley printing and production rates. Tests under a variety of printing conditions amply demonstrated that solvent-based inks, when properly formulated, present no fire hazard. In fact, it was found that correctly formulated solvent-based inks do not ignite even when placed in direct contact with electrical heating elements.

These developments made continuous valley printing possible. With solvent-based inks, deposits do not build up on printing or furnishing roll surfaces. Printing is sharp, the inks have excellent adhesion, and they can be produced in all colors, including metallics. Coagulation of ink in the fountain and during storage is eliminated. Most important of all, ink which drys on press surfaces during prolonged stoppages redissolves immediately upon contact with fresh ink from the fountain. All of the properties which gravure printers of plastics require for the job are now available in solvent-based valley inks.

Experimentation with embossing valley-pattern rolls indicated that most of them can be successfully used for valley printing. In design of embossing rolls, sufficient tolerance must be provided between the lowest printed areas in the pattern and areas of lesser depth to avoid inking those sections of the pattern where printing is not desired. To avoid flooding the pattern, ink must not be fed at a greater rate by the furnishing roll than it can be deposited on the plastic film by the embossing roll. Control of ink feed is achieved by using a fine screen line roller, wiped by an adjustable doctor blade.

Problems were also encountered in the proper selection of rubber rollers. Some swell in contact with solvent inks, with resulting poor transfer of ink. This can be overcome by periodic substitution of rolls as they become over-sized, re-machining the rolls to size as necessary. All valley printing presses are now equipped with rubber rolls completely resistant to swelling.

Having eliminated most of the "bugs" in the process, converters are now concerned chiefly with improving quality and production rates. Conditions of pre-heating, speed of printing, and post-cooling have been worked out for both vinyl and polyethylene. Modifications in inks are necessary to take into account the individual properties of each plastic, but these were readily made. By using laminators equipped with valley printing heads, it has been possible to produce highly styled printed laminates of both vinyl and polyethylene and various textile fabrics. Vinyl laminates are enjoying wide use in automotive and household upholstery, while polyethylene-to-cloth laminates are being employed as tablecloths.

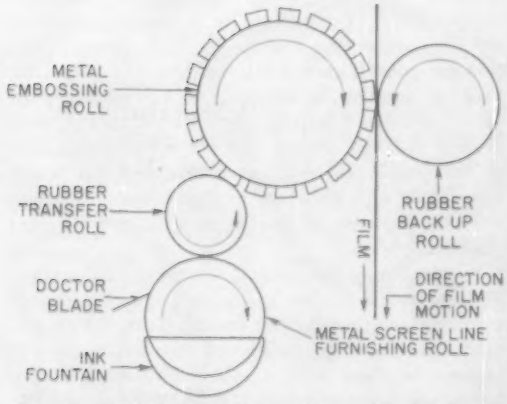
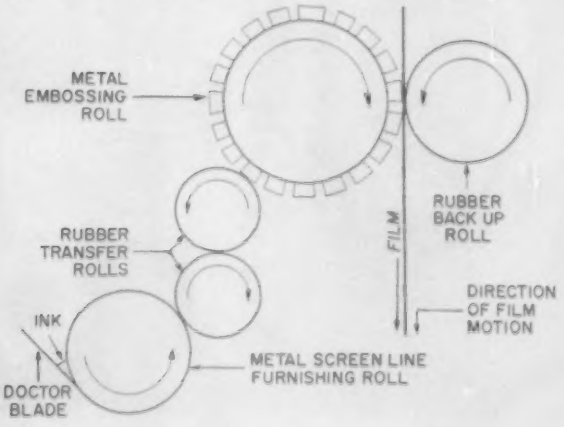


Fig. 3: Typical set-up for good printing results

Fig. 4: Another printing set-up that gives good results



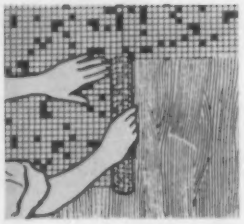
Polyethylene jewelry

Attractive, lightweight costume jewelry for summer wear is made from cool-looking petals fabricated of white molded polyethylene "snowflakes." The snowflakes are molded in a 25-cavity mold on a 3-oz. automatic injection machine at a rate of 5000 pieces per hour. Two flakes, placed one on top of the other and rotated 30 degrees with respect to each other, form one petal. The petals are attached to a cone-shaped mounting by means of a jeweler's rivet that goes through a molded-in hole in each flake. The cup-like shape of the petal results when the flexible polyethylene is drawn down into the mounting during fastening. Earrings consist of single petals; necklace and bracelet are made by joining a series of the petals with a metal chain.

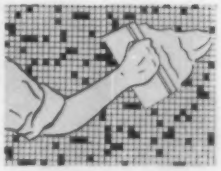
Credits: Flakes molded for Emmons Jewelers, Inc., Newark, N.Y., by Henry H. Lewis Co., Attleboro, Mass., on Fellows injection machines, using Tenite polyethylene supplied by Eastman Chemical Products, Inc., Kingsport, Tenn.



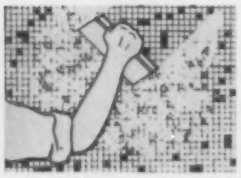
PLASTICS



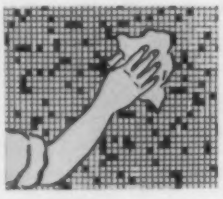
1: Mosaic sheet is applied to wall surface



2: Filler compound is spread into spaces between tiles



3: Excess filler is removed with trowel



4: Completed installation is polished

Small tiles for low-cost

Mosaic wall tile, injection molded of polystyrene in a great variety of patterns and colors, now make possible high-style home interiors at average-budget levels. Measuring $1\frac{1}{16}$ in. square, the tiles are supplied mounted to 16- by 16-in. gauze fabric backing panels, each panel holding 441 tiles. The backing, treated for adhesion to almost any surface, provides flexibility for mounting the tiles around corners, arches, and curved surfaces. Use of the small tiles eliminates much of the waste associated with the larger sizes; it also permits intricate patterns unobtainable with conventional plastic tiles.

Installation of the tile is a relatively easy matter. First, mastic is applied to the wall and spread with a notched, rubber-backed trowel. Next, the gauze-mounted tiles are positioned on the wall and pressed in place with a roller. Following this, a latex-base filler compound is deposited on the tile surfaces and spread into the spaces between the tiles, forming the grouts. Excess filler is then re-



Utility container

A handsome molded polyethylene utility container joins the growing family of polyethylene products being designed to lighten household chores. The covered container can be used as a storage or disposal unit in nursery, kitchen, bedroom, or bathroom. Molded in one piece (with no seams to catch dirt or hinder cleaning), the lightweight container stands easily on counters or shelves. Built-in metal loops in the back of the container also permit the unit to be hung on closet or cabinet doors, e.g., inside closet doors for storing household articles or inside kitchen cabinet doors for disposing of waste or garbage. Molded-in handles on top and sides add extra convenience.

The cover and body of the container are each injection molded in single-cavity molds, on a 24-oz. machine. The container is available in pink, turquoise and yellow with chalk white covers.

Credits: Molded by Plastray Corp., Detroit, Mich., from resin supplied by the Bakelite Co., New York, N.Y.

PRODUCTS

mosaic walls

moved from the surfaces of the tiles. Since the tiles are precision-aligned on the fabric backing, uniformity of grouts is achieved automatically.

The mosaic tiles are injection molded in an 8-oz. machine using multi-cavity molds and running at 7-oz. shots per cycle.

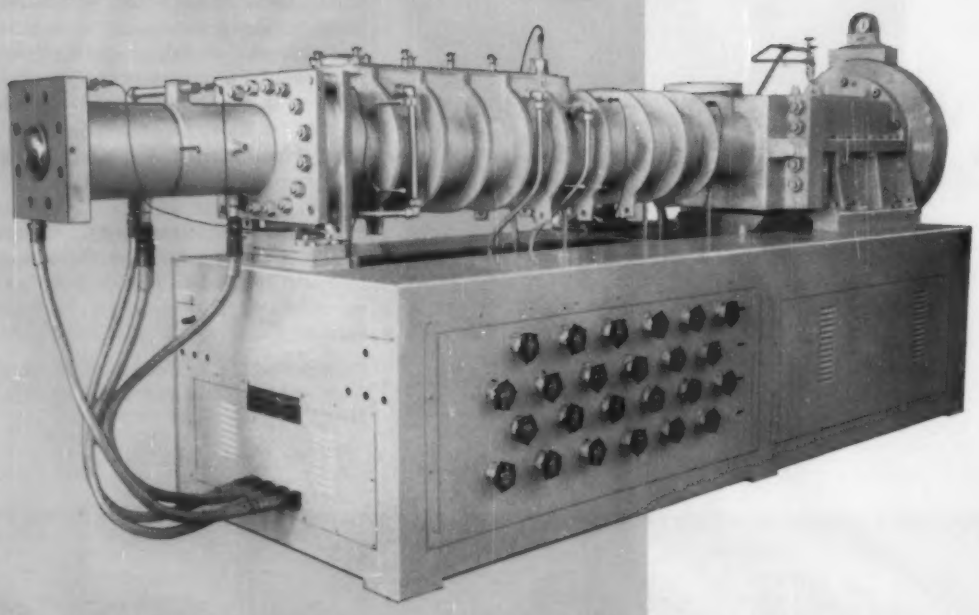
The tiles are available in four basic pattern groups. The "Pearl" group consists of pearlescent tiles in any of several colors mingled with black tiles. "Granitone" is a series of single color tiles incorporating minute particles to give a granite effect. "Four-tone" mixes tiles of four patterns and colors, and "Randtone" consists of marble-like tiles mixed at random. Adhesive, filler, and tools are supplied with the tiles.

Credits: Tri-Bond Mosaic wall tiles designed and molded by Mastro Plastics Corp., Bronx, N.Y. Styrene resin supplied by Catalin Corp. of America, New York, N.Y.



tion is polished

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Plastics Engineering*

Dr. James F. Carley, Engineering Editor

Rubber tools for reinforced molding

By R. Thompson†

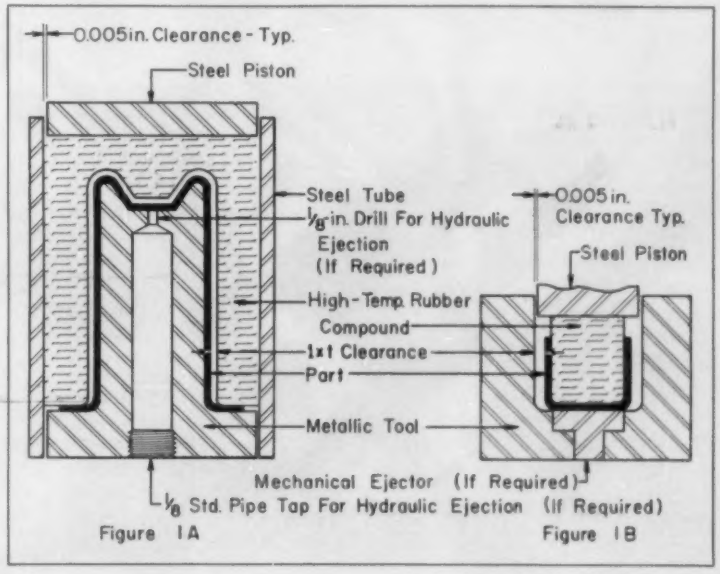
Many reinforced plastics objects which have required matched metal molds may now be made in molds that are half metal, half rubber. The rubber "mate," which can be either the male or female half, is cast from heat-resistant silicone rubber. As the mold closes, the mate deforms and forces the molding compound, usually a pre-impregnated glass fabric, to assume the shape of the metal half of the mold. The process may be thought of as a very-high-pressure bag molding process in which rubber compression does the work of the usual air pressure.

A new, low-cost tooling technique permits the production of glass cloth laminate parts which are comparable in quality to those made with expensive matched metal molds. Typical tool designs are shown schematically in Figs. 1A and 1B, right. Figures 2A and 2B show what goes on in the closed mold.

The male or female nature of the tool used in each instance depends on the detail design of the part to be molded. In general, parts requiring close internal tolerances are made with metal male tooling and parts requiring close external tolerances are made with metal female tooling. Some rubber tools and moldings made with them are shown in Fig. 3, p. 116.

Rubber mates for metal tools have to date been made from high-temperature silicone elastomers with Durometer hardnesses of 55 to 65. Their fabrication involves casting the uncured resin in each instance over a plaster tooling pattern positioned within a seamless steel tube, internal surfaces of which are bored and polished in order to minimize friction during the pouring operation. After it has been cast, the elastomer is cured

Fig. 1: Recommended design information for silicone rubber semi-tooling. Note particularly the extra-large clearance between metal tool and its rubber mate



*Reg. U.S. Pat. Off.

†Tool Engineer, Convair-Ft. Worth Div., General Dynamics Corp., Fort Worth, Texas.

with heat but with no pressure other than its own weight.

Both silicone greases and high-temperature petroleum waxes have been satisfactorily used to prevent the adhesion of lamination materials to rubber and metal tooling surfaces.

How tools are used

In the molding process, lamination materials impregnated with plastics are usually laid up on the rubber or metal unit that serves as a male mold and the resultant assembly is inserted in the rubber or metal unit that serves as a female mold. Then metal platens transfer heat to the laminate in the usual way. It should be noted that since heat is supplied from only one side, it takes considerably longer to reach a given temperature in the laminate than it would with the two-surface heating obtained in matched metal molds.

Minor experimentation is necessary prior to the production of each new part in order to determine the compressive force that will most satisfactorily displace rubber and thus apply pressure to the lamination materials. The correct pressure should then be stamped on the metal male or female tool for future reference.

Following a given molding cycle, the tooling assembly is removed from the compression press and allowed to cool to room temperature before dismantling.

The hydraulic ejector shown in Fig. 4, below, is used by Convair-Ft. Worth to separate parts made with tools having no allowable draft. Regular mechanical separa-

(*To page* 210)

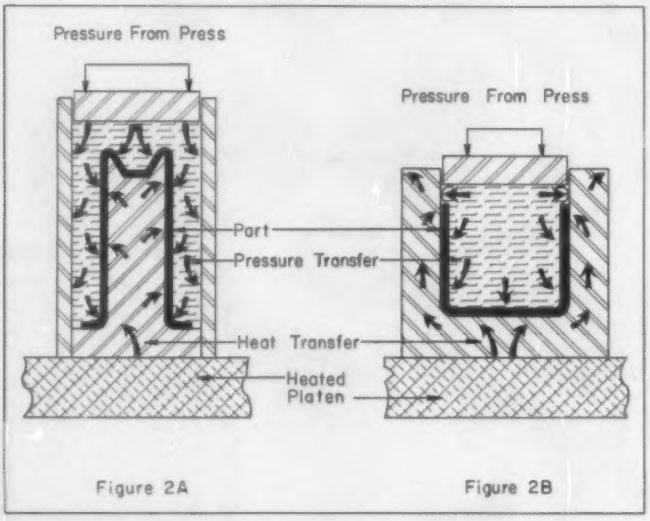


Fig. 2: Tools of Fig. 1 in mold-closed position. Silicone rubber is compressed, applies pressure on all surfaces of laminate. Best tolerances and finish are obtained on side in contact with metal

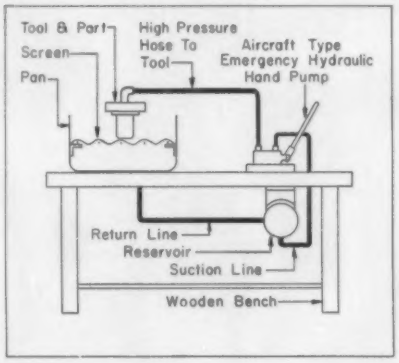


Fig. 4: Hydraulic piece ejector used for feeding cured laminates having no draft from rubber tools

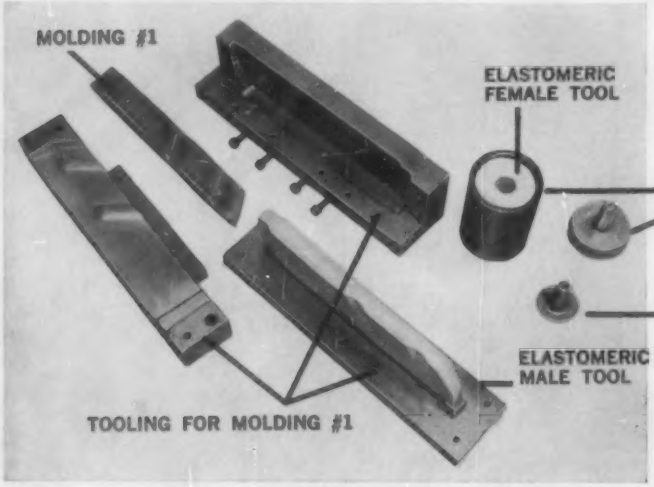


Fig. 3: Sample rubber-mate tools and resulting glass cloth-polyester laminates

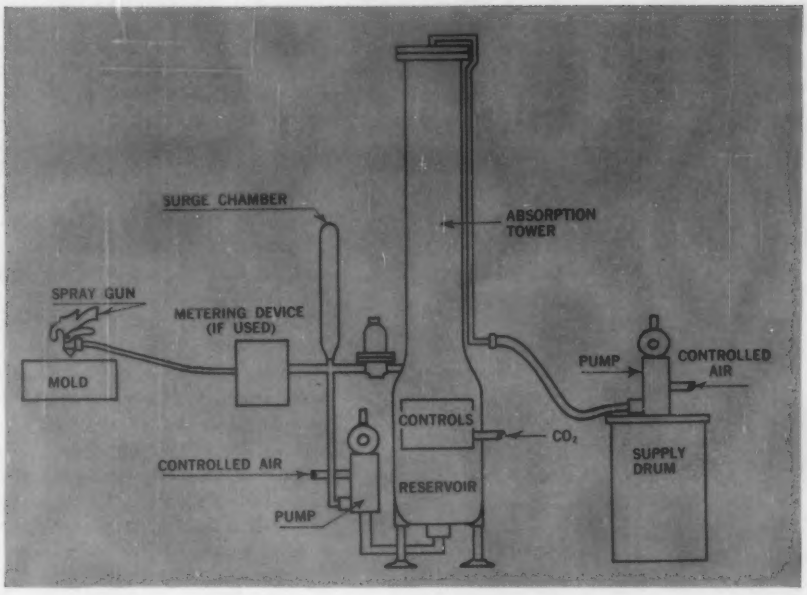


Fig. 1: Flow chart of vinyl foam production by counter-current absorption of CO_2 by vinylsol. Pressurized absorption tower is heart of this process

Vinyl foam by counter-current absorption

CO_2 gas under pressure is absorbed into plastisol in packed tower to yield a solution that can be stored, can be piped throughout plant, and foams on release of pressure

*By George J. Crowdes, Jr.**

The foaming of most thermoplastics is based on one of two techniques: 1) chemicals added to the resin evolve nitrogen or carbon dioxide gas under the influence of heat, and 2) air or some other gas is mechanically whipped into the resin, much as it is whipped into egg albumen to make meringue.

In the first technique, the chemicals are known as blowing agents, and their action must usually be assisted by some form of mechanical working or agitation. The working helps improve point-to-point uniformity of temperature, which in turn leads to more uniform blowing rates and more uniform cell sizes and density in the finished foam; and, the agitation may also serve to distribute the blowing agent evenly throughout the resin mass. Neither of these two methods produces foams having high uniformity of cell structure. They also have other disadvantages: cost of blowing agents, short working time, difficulty of getting heat uniformly into the resin mass, and clean-up problems.

A new technique for production of vinyl foam bids fair to overcome many of these difficulties. Plasticized vinyls differ from other foamable thermoplastics in that they contain a high percentage of plasticizer. Gases are not very soluble in resins, even under pressure, but in many plasticizers carbon dioxide (CO_2) exhibits a large Henry's Law constant (pressure coefficient of solubility). Under moderate pressure—less than 100 p.s.i.g—it is possible to dissolve as many as 20 volumes of CO_2, measured at standard conditions, into one volume of plastisol. Immediately on release of pressure and without mechanical aids, the carbonated vinylsol[1] ex-

*Dennis Chemical Co., 2701 Papin St., St. Louis, Mo.

[1]Ed. Note: The term "vinylsol" is introduced to distinguish the vinyl-based plastisols and organosols from those based on other resins.



Fig. 2: Chromcraft vinyl foam cushion plant, showing foaming and unloading point. Operator at top charges one of 12 molds on rotating rack with carbonated vinylsol from foamer (tower behind him); workmen below unload fused, cooled cushions

pands into foam having a very uniform cell structure. Heat effects are small and perfectly distributed.

Another unusual property of plasticized p.v.c. completes this pleasant picture: its high dielectric loss factor at high frequencies makes it easy to fuse the vinylsol by well developed HF methods that generate heat uniformly throughout the mass. A wide range of controlled densities can be obtained by simply varying the CO_2 pressure during the dissolving step. Since the solubility is also dependent on temperature, increasing with falling temperature, it is possible, by juggling absorption pressure and temperature, and plastisol make-up, to get whatever combination of finished foam characteristics and pouring characteristics is desired. Molds may be pre-sprayed with a non-foaming vinylsol and filled with foam; a one-step cure would then give cushions, etc., with integral vinyl skins.

To dissolve CO_2 in plastisols, intimate contact of the gas and liquid must be achieved. This can be accomplished by mechanical agitation in a pressurized vessel, but the method suffers from the troubles connected with rotating equipment and pressure seals around shafts.

Another technique is countercurrent absorption, a standard chemical engineering practice. As commercially developed in the Fay Foamer[2], the process involves trickling the plastisol downward through a short packed tower into a storage reservoir at the bottom; CO_2, flowing upward, contacts the liquid in thin layers over the tremendous area of the packing. With proper adjustment of rates, equilibrium is reached under the existing temperature and pressure, and the plastisol collected in the reservoir is saturated. Ideal operating pressure range is 30 to 90 p.s.i.g. Where very high production rates or low densities are wanted, a two-stage absorber can be used.

Since the reservoir is at the same pressure as the absorber, the dissolved CO_2 stays in solution indefinitely, while gentle circulation of the absorber's contents prevents stratification.

The pressurized solution can be piped for considerable distances. In the Fay Foamer an air pump is used to accomplish all such transfers, the pump pressure being set a little higher than the tower pressure so there is no foaming in the pipes. Several outlets can be used on the same line with no difficulty. Figure 1, p. 117, is a schematic diagram of the foaming apparatus.

To accommodate intermittent production demands for carbonated plastisol, the fresh plastisol and CO_2 inputs to the absorption column are controlled by a level-sensing float in the reservoir. If the reserve level rises too high, input to the column is stopped. Falling level automatically restarts the absorption process with no deviation in the density or

(*To page* 212)

[2]Dennis Chemical Co., St. Louis, Mo., is exclusive distributor of the Fay Foamer.

Fig. 3: Completed seat cushions ready for transfer to upholstering department. In background, mold racks can be seen emerging from oven. These mold racks start cooling on return trip to the unloading point shown in Fig. 2, above. (Illustrations, Dennis Chemical Co.)



Engineering the plastics "House of the Future"

Part 2

By A. G. H. Dietz,[1] M. E. Goody,[2] F. J. Heger, Jr.,[3] F. J. McGarry,[4] and R. P. Whittier[5]

In the first half of this article on the Monsanto plastics house of the future, which appeared last month, the architecture of the house, the variety of dead, live, and thermal-expansion loading to which it would be subjected, and the considerations governing the selection of the plastics materials were discussed. In this part, the structural design details and the testing of a prototype structure are taken up.

Structural analysis and design

Initial studies indicated that maximum stiffness and most efficient use of materials would be achieved if the structure were "statically indeterminate." Load and stress distribution in such a structure are markedly affected by the proportions of the various parts of the structure, hence a thorough preliminary design was necessary before the final analysis could be made.

The required stiffness can be obtained by provision of suitable depth of box section, suitable skin thickness, and by selection of material with suitable modulus of elasticity, since stiffness is a function of *EI*, the modulus of elasticity times the cross-sectional moment of inertia. *I* is a function of flange separation and thickness. Allowable maximum end deflection of the 16-ft. cantilever sections was taken as ¾ in. or L/265 with full live load on floor and roof. Preliminary study indicated that with the maximum flange separation (i.e., maximum depth of box section) commensurate with architectural appearance and practical maximum thickness of material, the skin material must have an *E* of at least 2,000,000 p.s.i.

The thickness of the webs forming the sides of the box was chosen to provide sufficient shear area and to provide safety against diagonal compressive web buckling with the use of a limited number of reinforced plastic stiffening ribs.

The bottom flanges of the lower bent and both upper-bent flanges are reinforced near the core end with honeycomb or rigid polyurethane foam, covered with thin interior skins to provide resistance to buckling.

Because of length of time required to make molds and develop fabrication techniques, exact shape and structural arrangement of the cantilever box section wings was established from the preliminary design. This necessity made it difficult to attain the simplest connection details in the later structural design.

The core section was designed as a continuation of the cantilever wing bents coming in from four sides. In the final design the upper core section functions as a center-span connecting beam between opposite cantilever wings. Upper and lower sandwich panels act as flanges for this beam and laminated wood perimeter and center cross beams act as webs. Of course, adequate connection capacity must be provided at junction of flange and web to transmit horizontal shear forces which occur under the action of unsymmetrical load on the wings. This core structure, it is noted, is subject to two-way action from cantilever wings on four sides. Also, sandwich panel flanges must function both as compression and as tension members: the effect of the sun's heat on the roof is the opposite of the effect of a full snow load.

Vertical reactions from the interior sides of the cantilever roof bents and from the core roof load are transmitted by the laminated wood core perimeter beams to four columns at the corners of the core. These four spirally wound, reinforced plastic pipe columns support the greater portion of vertical loading on the wing and core roofs.

The lower core, in the final design, is a stiff box having reinforced concrete foundation walls and slab, and a sandwich-panel floor over a single intermediate laminated-wood support-beam (Fig. 7, p. 120). Sufficient weight is provided to give safety against overturning under unsymmetrical loading on the wings. Unit soil pressure is held to less than 1500 lb./sq. ft. because the house will be constructed on compacted fill. (Any differential settling of the slab would result in approximately twice as much sag at the outer ends of the wings.)

The actual roof over the core section is raised above the double sandwich panel upper core structure, mainly for architectural reasons. This outer roof structure is made of a single skin of reinforced plastic molded in the shape of a gently curving hyperbolic paraboloid in four quadrants with the peak in the center (Fig. 7). This curved shape offers greater resistance to vertical loads than would a plane surface.

Many arrangements for the core

[1]Professor of Building Engineering and Construction and Chairman of Plastics Committee, Massachusetts Institute of Technology, Cambridge, Mass.
[2]Hamilton & Goody, Architects, Cambridge, Mass.
[3]Assistant Professor of Structural Design, M.I.T.
[4]Assistant Professor of Materials, M.I.T.
[5]Project Engineer, Plastics Div., Monsanto Chemical Co., Springfield, Mass.

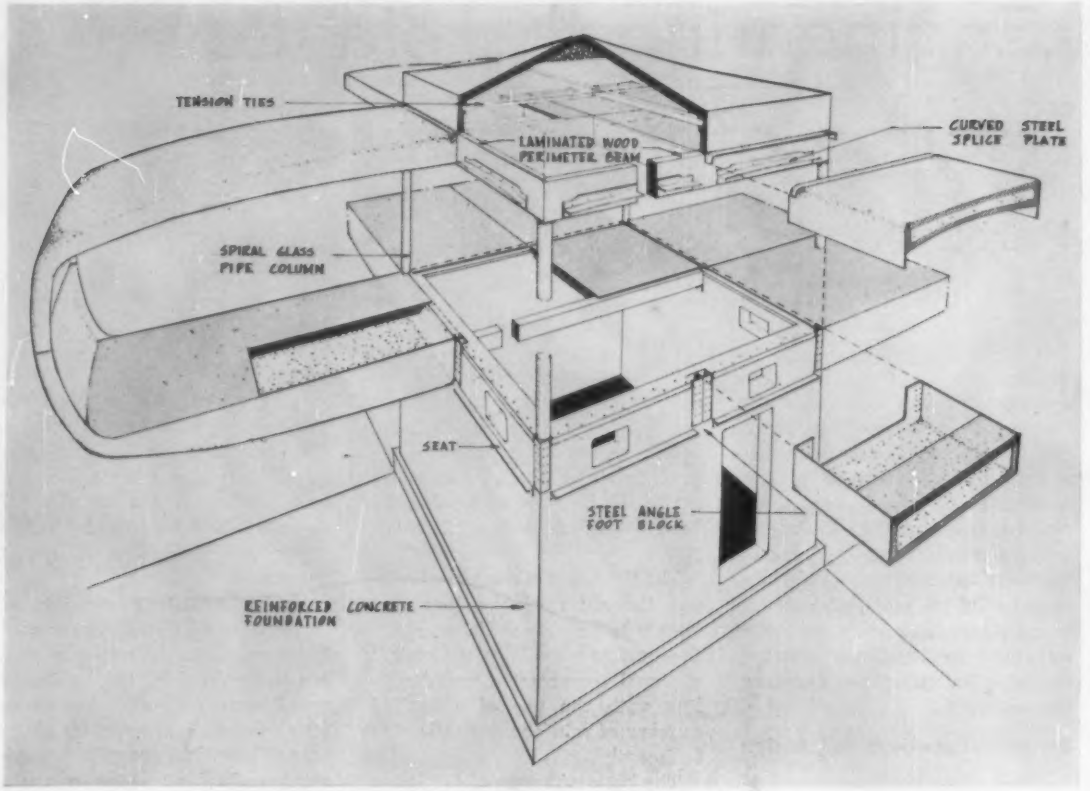


Fig. 7: Exploded, cut-away view of house shows construction details. Erection operations are simple and quick

structure were considered. Early thought was given to arrangements that permitted elevation of the first floor above a reinforced concrete foundation mat, but without the use of heavy concrete foundation walls. The most promising of these schemes envisioned the use of a lightweight sandwich panel with reinforced plastics skins and cellular plastics core which would provide for support of all vertical load from the structure, enclosure of the basement space, and resistance against racking[1] under lateral loading on the parts of the house structure subjected to twisting moments by unequally distributed live loads. Although such an arrangement would have given a greater utilization of plastics in the house structure and a much lighter structure, budget and time limitations did not permit its further development for use in this house. Instead, the stiff concrete box-type foundation was adopted. This design provides greater stiffness to the lower cantilever bents and also eliminates the need for a lower sandwich compression panel in the core floor.

The upper and lower pairs of bents are tied together at their end-wall mid-height by a single line of bolts to provide a weather-tight joint, resistance to racking under lateral load, and greater over-all stiffness under vertical loading. This connection makes the structure "indeterminate," considerably improving the over-all stiffness, but at the expense of magnifying stresses caused by thermal expansion and support movements. In view of the rather large coefficient of expansion of the reinforced polyester, thermal stresses are of considerable importance.

In order to make a final analysis of the structure under vertical loading, the structure is considered to be made up of two continuous indeterminate bents at right angles to each other. Due to symmetry, each of these bents can be considered to act as an independent structure. Approximate relative stiffness values for various parts of this structure were computed from proportions established by the preliminary design. The structure was then considered separated at the outboard hinge into two determinate structures, deflection of adjoining portions under applied and restoring forces computed by the method of virtual work, and redundant forces on the structure calculated from consideration of super-position of deformation effects. Once the redundant forces had been thus computed, moments, shears, thrusts, and deformations at critical points in the structure could be computed from statics. Stress levels and deformations at critical locations in all the various parts

[1] *Racking* means being forced out of shape or out of plumb.—*Ed.*

of the structure were then compared with allowable values and the preliminary design revised as required.

Maximum deformation at the outer end of wings was computed as approximately ¾ in. under full live load on all wing floors and roofs. Maximum normal stress levels were not expected to exceed about 1000 p.s.i. at critical points, except at connections.[2]

Because of relatively sizable forces associated with moment-resisting connections, design of connections between various parts of the structure had considerable influence on the over-all design for the structure. Moreover, there was a general requirement that the house must be easily disassembled and made ready for re-erection on some new site. This precluded the use of a simple permanent connection method, such as adhesive bonding. In setting up criteria for bearing-type connections, allowable bearing stress on the fibrous glass-reinforced polyester was held at a relatively low percentage of the ultimate compressive strength of the material, because of the lack of ductility and consequent inability to redistribute concentrated stress. Allowable bearing stress was taken as 4000 p.s.i. over the projected area of the connection, such as a bolt.

In order to transfer the relatively large forces present at the connections in the core area, it was found necessary to increase thickness of various abutting parts in the area of the connections.

For the lower cantilever bent-to-foundation flange connection, machine screws were used in combination with adhesives.

Vertical reaction for the floor cantilever bents is provided by steel shoes bolted to the bent web and set in pockets in the concrete foundation (Fig. 7).

Most connections of the upper cantilever bent-to-core section are made by using lag bolts that pass through lapped abutting parts into laminated wood spandrel beams and cross webs. Connection of the curved ceilings of the upper bents to the flat core sandwich is done with a special curved steel tee and by bolts through the spandrel beam (Fig. 7). This connection could have been greatly simplified if the wing ceiling could have been flattened in the region adjacent to the core. However, construction of ceiling molds was too far along by the time this connection was considered in detail.

Vertical reaction of the upper cantilever bents is provided by a bolted web connection to the spandrel beam. Spandrel beams are supported by direct bearing on top of the four corner columns. Connection between beam and column is also designed for uplift. Columns are supported on the exterior footblocks of the lower bents.

Provision for fairly loose tolerances is made in design of all field connections. Fill and slip plates are specified where required to obtain tight fit and final adjustment of parts is accomplished after major erection. Moreover, to insure tight bearing of all flange connections, holes for these connections are to be drilled in the field, and alignment of parts can be completed with shims.

Resistance to racking under lateral load (wind and earthquake) is provided by the four walls at the outer ends of the wings. Lateral load is transferred to these end walls by bending in the plane of the structural roof, and from the end walls to foundation walls by bending in the plane of the floor bents. A check was made for resistance to twisting about the center of rotation under unsymmetrical lateral load.

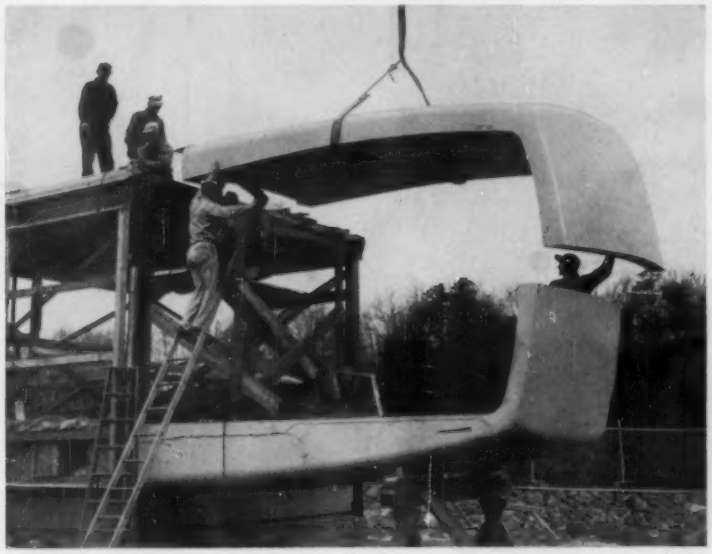


Fig. 8: Upper bent of prototype structure, molded in same mold used to make bents for house, being moved into place with crane

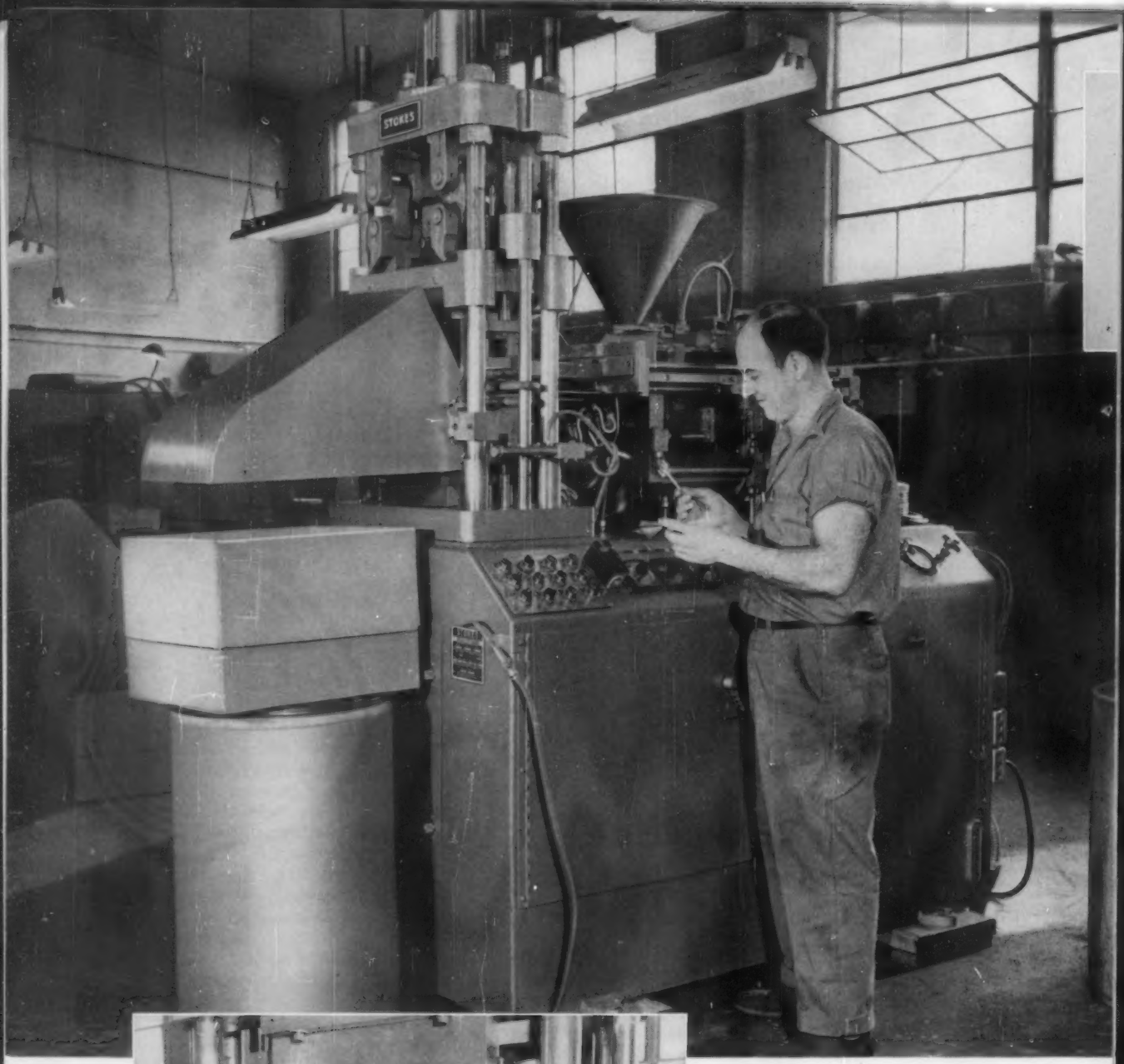
Materials considerations

It is apparent that the architectural design of the house imposes some severe requirements upon the materials to be used in its construction. Because of the large sizes and shapes of the structural units chosen, a hand layup, vacuum-bag method of fabrication was the only relatively economical process possible on this scale of manufacture. This, and the need for maximum stiffness because of the cantilever action in the design, led to a study of glass fabric-reinforced polyesters from the point of view of mechanical and physical properties, raw material costs, and fabricating costs and difficulties. Also, the modulus had to be at least 1.5×10^6 p.s.i., preferably 2×10^6.

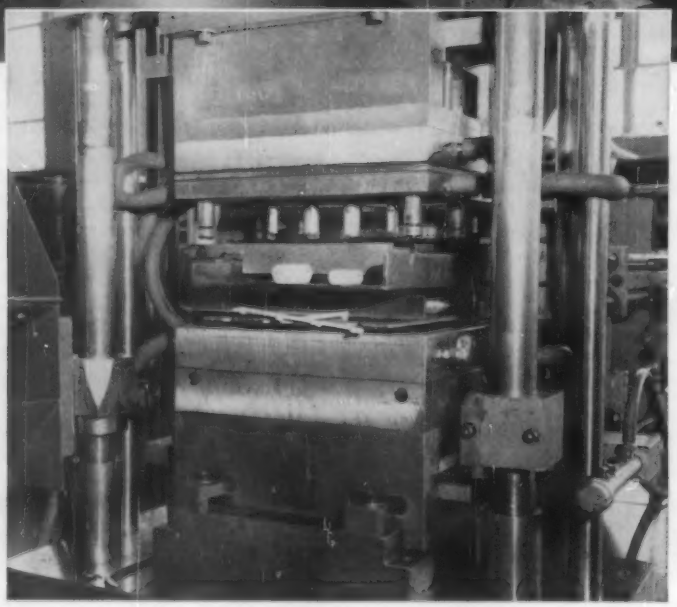
Within these limitations, two

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[2]These calculations filled 54 closely written 8½- by 11-in. pages.—*Ed.*

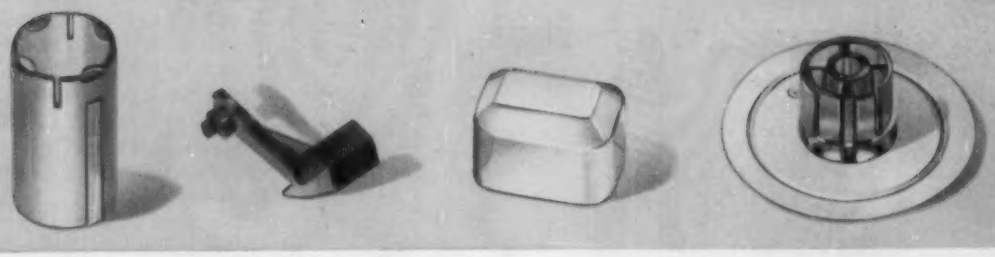


Foreman Michael R. Valentine makes production inspection of parts produced on one of the Stokes Model 701 Automatic Injection Molding Presses at work in the Stamford, Connecticut plant of Atlantic Plastics, Inc.



Automatically separated parts and runners are pushed (not blown) from the die area of the Stokes Model 701.

A few of the many intricate parts produced at Atlantic Plastics, Inc., on the Stokes Model 701 Presses.



Atlantic Plastics, Inc., relies on Stokes Model 701 presses for lower cost production of precision parts...

Fully automatic injection presses enable this well known custom molder to produce a variety of intricate parts at low prices.

At the Stamford, Connecticut plant of Atlantic Plastics, Inc., four Model 701 Stokes automatic injection molding presses have been installed and two more are scheduled for early delivery. Atlantic Plastics was one of the first companies to successfully mold nylon — and are nationally known today for their ability to handle all types of thermoplastic resins.

Joseph E. Benoit, President and General Manager, when asked why Stokes presses were selected, stated "These machines will help us maintain our reputation for quality molding, while at the same time affording our customers lower prices for the injection molded parts they buy from us."

One of the major operating advantages of the Stokes 701, 2-ounce press, is the simplicity of the tooling required. From a practical standpoint, the small simplified mold costs less . . . enables faster set-up and changeover . . . provides higher uniformity and quality of the finished product. Thus, a 701 can produce lower cost parts through less labor, faster cycles, and higher efficiency.

The Stokes Model 701 incorporates the Stokes patented ejection system which positively clears all parts and runners from the die . . . assuring *continuous* automatic operation. Secondary protection is provided by use of the more common low-pressure close. It is a complete, self-contained molding plant. Its vertical design saves floor space . . . permits sorting of parts and separation of sprues and runners . . . facilitates mold set-up.

Write to Stokes today for your copy of literature describing the Model 701 2-ounce fully automatic injection molding press—ask for a Stokes Production Analysis on your own parts.

Plastics Equipment Division
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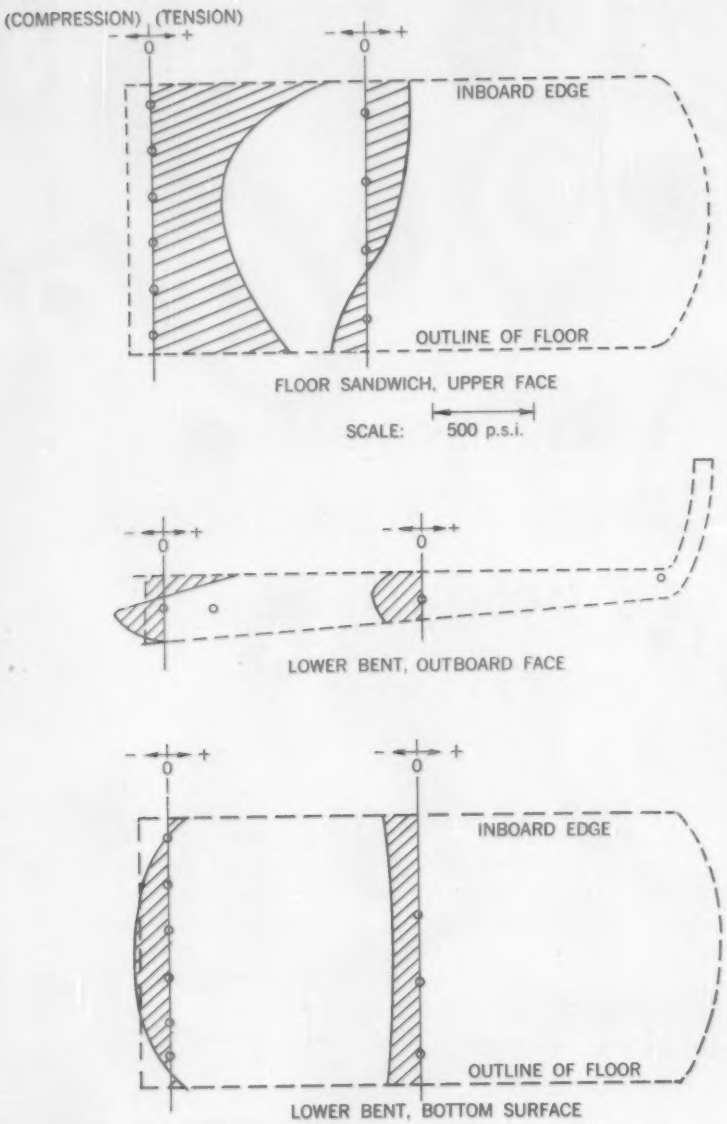


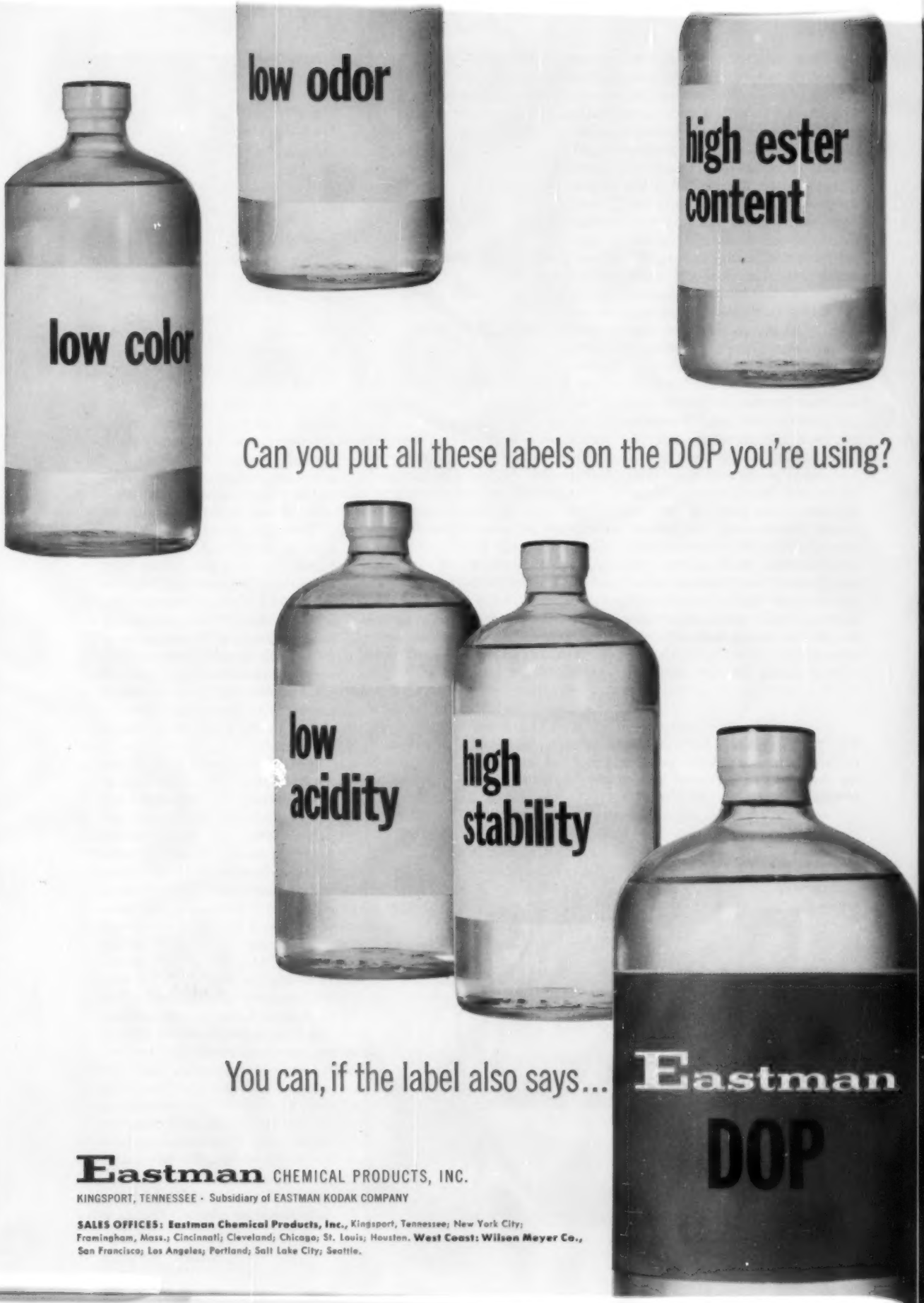
Fig. 9: Distribution of longitudinal stresses in surfaces of lower test bent under design load of 50 p.s.f. on floor, 40 p.s.f. on roof. While most of stresses were reasonably symmetrical (as was nominal loading), longitudinal stress across middle of floor ranged from tension (inboard) to compression at the other edge. This anomaly may have been due to observed local slipping of fastening bolts and crushing of wood in test frame. Although load across floor was uniform, stress varies from maximum at edges, where it is in direct contact with the web, to minimum at center. This variation is typical of shear lag effect

variables remained to be selected: resin and reinforcement. Of importance in the former were such characteristics as weathering resistance, fabricating ease, flammability, strength of finished laminate, and cost. Manufacturers' data on exposure programs were the principal source of information on weatherability. The developmental fabricator, under production conditions, provided the best evaluation of resin fabrication characteristics. For safety reasons, a fire-retardant polyester was chosen for use in the inner laminates of the structure while exterior surfaces, exposed to sunlight, were made with non-treated polyester since the fire-retardant formulations generally exhibit inferior weather resistance. This was judged to be a defensible compromise, especially since the entire building has complete sprinkler protection.

The question of the proper reinforcing fabric to use was first approached by reference to the literature (1)[3]. A balanced fabric conducive to strength and stiffness in tension, compression, shear, and bolt bearing in the finished laminate was desired since these were the principal modes of stressing to be encountered in the house. A minimum modulus has been mentioned; this applied to tensile, compressive, and flexural properties. It was also necessary that corresponding minimum strength values be established. In this respect an interesting situation arose. The modulus, in conjunction with practical limitations of laminate thickness to avoid fabricating difficulties, quite well determined the depths of the various sandwiches and box sections in the structure to obtain the necessary stiffness. This, in turn, permitted a calculation of stress levels under the various loading conditions. Reference to the literature (2) indicated that these working-stress levels should be no greater than a certain percentage of the static test strengths of the material to minimize creep and avoid stress-rupture. An additional safety factor was applied such that the working stress arrived at was 20% of the strength derived from static tests. In essence, the design of the structure largely dictated the properties of the reinforced polyester laminate of which it was to be built.

Initially, a laminate of approximately 55% glass content with 181 fabric reinforcement was chosen for investigation. Panels fabricated by vacuum-bag techniques under shop conditions with a wet layup possessed tensile, compressive, and flexural properties well above the minima. With an eye toward economy, numerous com-

[3]Numbers in parentheses link to references at end of article, p. 127.



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binations of 181 fabric and 1½-oz. mat were investigated but all proved to be somewhat marginal with respect to both strength and quality variations. Consequently, the first test bent, a small floor section, was fabricated completely with 181 cloth. This included the outer shell and both faces of the floor sandwich. It resulted in a structural unit of exceptional integrity which passed the qualification tests with complete satisfaction. Unfortunately, however, 181 fabric is a rather expensive material to use in making a reinforced skin as thick as 3/16 inch. Costing over $1.50/lb., it is very thin, and 30 plies, each laid up individually, were needed to reach the desired thickness. There was also some difficulty in shaping this fairly tightly woven cloth to the compound curves and corners of the bent. In its stead, careful consideration was given to woven-roving fabrics, and one pattern was selected. This material costs about half as much as 181 cloth and is about three times as bulky, so the total thickness could be built up with considerable savings in the costs of both cloth and fabricating.

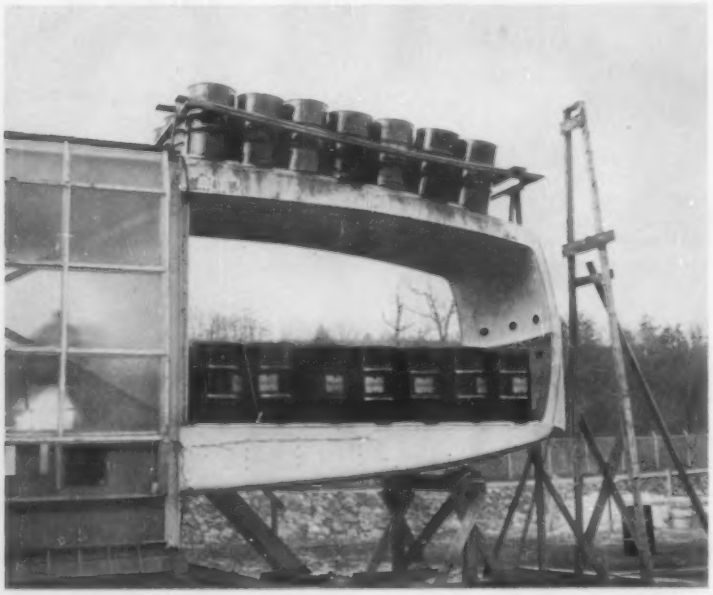
Test panels of this material were fabricated to the proper thickness under production shop conditions and the strength properties determined. It was immediately apparent that the tensile and flexural properties easily exceeded the minima; in compression, however, both strength and modulus values were deficient. To remedy this, a number of combinations of woven-roving cloth and other fabrics and mats were explored. None of these showed appreciable improvements in their compressive properties over the roving cloth alone. Since compelling economic and fabricating advantages were associated with the use of the roving cloth, it was decided to take the properties available from it and restudy the structural analysis to assess the effects of the lower compressive properties. As might be expected, the principal consequences were:

1) Shifts in the neutral axis location of some sandwich and box sections in flexure.

2) Modifications in laminate thickness at certain points in the structure.

3) Minor redesign of mechanical connections where bolt bearing data indicated such was needed.

Fig. 10. Test bents loaded with double the design load. Barrels are filled with water to get desired roof and floor loading; they rest on a blanket of foam so that the load is evenly distributed over the entire floor area



A second bent, composed of roof and ceiling shells, was constructed with the roving cloth reinforcement and subjected to the full-scale tests described below. Its performance in these was considered satisfactory and therefore the remainder of the structural shells were so fabricated.

Loading tests

The unusual character of the structural bent, in terms of the shape and the material of which it was made, recommended that full-scale tests be conducted upon it. The structural analysis had indicated which loading conditions would be most severe and the stresses and deflections to be expected under these conditions. As a consequence, an extensive and carefully executed testing program was performed by the engineers; strain measurements were recorded and interpreted by Lessells and Associates. Both the previously mentioned bents were tested, the roof-and-ceiling bent being made with roving cloth, the floor-and-bottom one being made with 181 cloth. To do this testing it was necessary to construct a framework of steel, concrete, and wooden members designed to simulate the rigidity of the actual house core. This test frame is shown in the left side of Fig. 8, p. 121.

Initially the lower bent (made from 181 fabric) was tested separately. After installation in the test frame, some two dozen strain gage rosettes were epoxy-bonded to points on the inner and outer horizontal surfaces of the bent, and to the webs. These rosettes consist of three gages at angles of 0, 45 and 90°, an arrangement that permits evaluation of all the principal stresses at each point. (The gage arrangements for several surfaces are shown in Fig. 9, p. 124.) Dummy gages helped compensate for the effects of local temperature variations on the readings of the active gages. In addition, a surveyor's transit was used to measure the deflection of the outboard end, as well as its twist, if any. Progressive, uniform live loads of 10.8, 20, 30, and 50 p.s.f. were applied. Under the designed-for live load of 50 p.s.f., the deflection was about 0.75 in., as

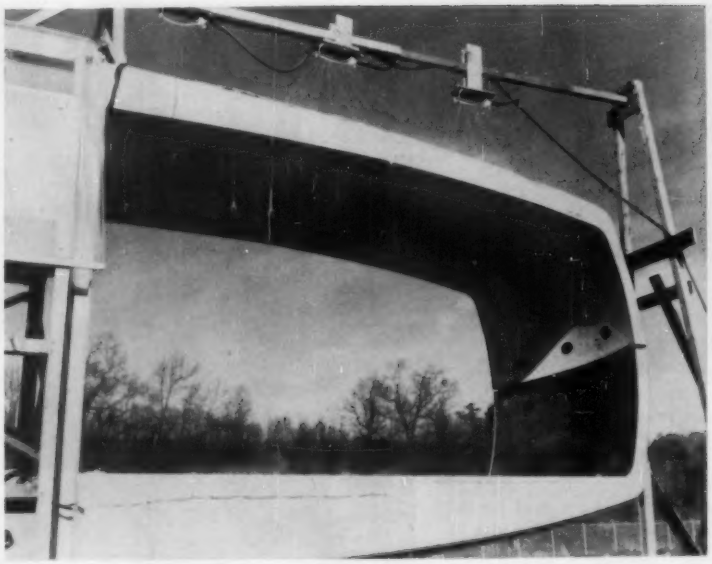


Fig. 11: Physical set-up for thermal loading test (heat-saving covering has been removed to show oscillating sprinklers in operation). Results of test showed both bents and joints were well able to withstand this type of loading

expected. The stresses, which were determined from the Mohr's circles for stress derived from the strain-gage readings, indicated that the stress analysis of the structure had been realistic. The maximum stress at this live load, i.e., the longitudinal tension at the outside edge of the floor sandwich near its point of attachment to the frame, was only 852 p.s.i. while the tensile stresses at all six points along the attached edge of the floor averaged 552 p.s.i. The distributions of longitudinal stresses in the floor, web, and bottom of the lower bent are also shown in Fig. 9, p. 124. Transverse stresses were, in general, much smaller.

The 50-p.s.f. live load was maintained for six weeks while several sets of gage and deflection readings were made to determine the amount of creep the bent was undergoing. No measurable creep in the bent was detected during this period, substantiating the choice of working stress levels as being conservative.

In a later phase of the program, after the roof bent had been mounted, a procedure often cited in municipal building codes was followed. The floor was loaded to 110 p.s.f. and the roof to 80 p.s.f., twice the design load. The set-up is shown in Fig. 10, p. 126. This is about equivalent to having some 150 people packed into one of the rooms (plus the furniture), with about 5 ft. of snow on the roof! Although this terrific overload was maintained for 48 hr., there was no significant creep. Deflection and strains in the bent were as anticipated.

The testing of the prototype structure continued with a thermal load test, in two parts. In part 1, the upper, or roof, bent was tested without the support of the lower element, while in the second part they were joined. Three oscillating lawn sprinklers mounted upside down over the roof sprayed 186° F. water on the surface (Fig. 11, above). An enclosure over the sprinklers and the roof reduced the heat loss. Thermocouples and strain gages, patterned much the same as were the gages of Fig. 9, monitored the temperatures and elongations at many points. The maximum difference in temperature from the inside ceiling surface to the sprayed roof surface was 70° F., the average over the whole roof at the height of the test being about 60° F. difference. The greatest stresses induced by this treatment were only 5% of the ultimate strength of the material, and the stress distribution was as anticipated. Even twice this temperature difference, which is far more than could be expected in actual use, would cause no serious stress.

This series of tests show that the house, though it has about the desired rigidity, is far stronger than it needs to be. This comfortable safety factor is the result of designing for stiffness with a material having a relatively high strength-to-modulus ratio.

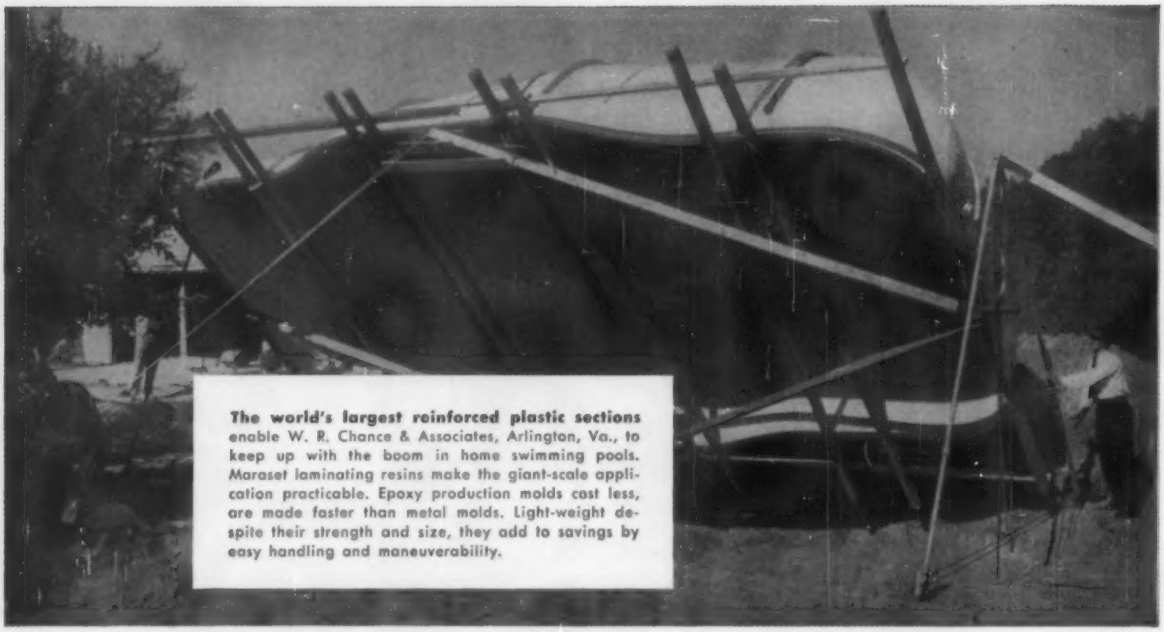
The testing of this structure is still going on. Acoustical tests were somewhat disappointing, but it is felt that in this respect the house is no worse than a house of standard construction. Sound deadening should improve considerably when the house is furnished. Other tests in progress include: determination of heating and cooling loads (expected to be low because of excellent insulation provided by foams in sandwich structures and by Thermopane glazing); long-time deflection testing; further testing on materials of construction, including a determination of the dependence of strength and hardness on curing temperature and time.

The testing completed so far has done much to deepen confidence in the applicability of structural theory to this complexly curved, multi-component structure; the test results have also created confidence in its ultimate field behavior. The final proof, of course, will be its performance in service. At Disneyland, with hundreds of people visiting it daily, the Monsanto House of the Future will stand a rigorous trial.

References

1) "Plastics for Aircraft, Part 1, Reinforced Plastics," ANC-17 Bulletin, U. S. Printing Office, Wash., D. C. (1955).

2) Boller, K. H., "Effect of Long-Time Loading on Glass-Fiber-Reinforced Plastics Laminates," Proceedings, Eleventh Annual Technical and Management Conference, Reinforced Plastics Division, S.P.I. (New York City, 1956).



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Effect of radiation on polyethylene

By V. L. Lanza†

The extensive and ever increasing use of polyethylene in wire and cable technology and other applications has led to many interesting new studies with this versatile material. Considerable interest has arisen over the past few years on the effects of radiation on polyethylene (1-15).[1] It has been shown that when polyethylene is exposed to ionizing radiation, e.g., high-energy electrons, gamma rays, or atomic pile radiation, cross-linking of the polymer chains occurs along with some chain scission and formation of unsaturation. The technologically most important reaction, cross-linkage, leads to an initial increase in molecular weight, followed by, at sufficiently high doses, a three-dimensional gel structure.

As would be anticipated, the irradiated polyethylene appears to have properties that would be expected for a cross-linked material. In general, an increase in dose leads to greater and greater insolubility, to changes in tensile properties, and to better form stability at higher temperatures. The polyethylene undergoes a transition with increasing irradiation dose from a plastic to an elastic material.

The experiments undertaken in this study were designed to shed some light on some of the important physical and electrical changes that take place when polyethylene is irradiated. The experiments were further designed to evaluate these changes quantitatively. Since one of our main interests in polyethylene was in wire and cable applications, the irradiation doses chosen and the instrument used to perform the irradiation were selected from practical engineering considerations rather than from purely theoretical ones. The doses used were ½, 2, 8, 32, and 64 million reps, a rep being the roentgen equivalent physical. This unit is defined as the quantity of ionizing radiation which, upon absorption in 1 g. of body tissue or water, is accompanied by the gain of 83 ergs of energy.[2] The instrument used was a High Voltage Engi-

[2]Polyethylene is very similar to water in radiation absorption.

Table I: Melt index at 190° C. and plastic recovery

Material	*Irradiation dose* 10^6 *reps*	*Melt index*	*Plastic recovery* %
DYNH	0	1.46	57
	½	1.02	68
	2	0.13	156
	8	No flow	—
Alathon 10	0	2.25	52
	½	1.56	58
	2	0.26	170
	8	0.002	Not measurable
DYNH + DPPD	0	2.10	50
	½	1.50	58
	2	0.30	168
	8	0.005	Not measurable
DYNH + DPPD + Carbon black	0	1.62	41
	½	1.28	47
	2	0.53	102
	8	No flow	—

*Reg. U.S. Pat. Off.
Presented at the Fifth Annual Signal Corps Symposium on "Technical Progress in Communications Wire and Cables.
†Bell Telephone Laboratories, Inc., Murray Hill, N. J.
[1]Numbers in parentheses link to references at end of article, p. 136.

neering Corp. Van de Graaff generator, model JS, operating effectively at 700 kilovolts. Since the instrument was capable of delivering only 25 w., it required approximately 1 min. to irradiate a sample to a dose of 1 million reps. Thermal effects were minimized by this slow irradiation and oxidative effects were reduced to a minimum by maintaining an atmosphere of nitrogen at all times during the irradiation of samples. By judicious placement of samples, it was possible to irradiate samples with a maximum cross-sectional variation in energy of about 15 percent.

The materials chosen for this study were also selected from practical considerations. Two standard grade polyethylenes, Alathon 10 produced by E. I. du Pont de Nemours and Co., Inc., and DYNH produced by Bakelite Co., were selected since they represented at the start of this study the two most widely used polymers. To study further radiation effects on compounded materials, DYNH plus 0.07% DPPD (N,N'-diphenyl - p - phenylenediamine) and DYNH plus 0.07% DPPD and 0.5% Kosmos BB (fine-particle-size channel black) were also studied.

Table II: Melt index at 267° C. and plastic recovery of DYNH polyethylene

Irradiation dose	*Melt index*	*Plastic recovery*
10^6 reps		*%*
0	9.77	60
½	5.93	69
2	1.14	130
8	0.02	Not measurable
32	No flow	Not measurable

Physical properties

Melt viscosity and plastic recovery: The melt viscosity of the various samples was measured by the method outlined in A.S.T.M. D 1238 and is reported as melt index. The plastic recovery was measured by a Bell Telephone Laboratories method in which the percent increase in diameter of the extrudate from the extrusion plastometer is calculated. Examination of Tables I, p. 129, and II, reveals that the melt viscosity increases with increasing radiation until at a dose of 8 million reps there is for all practical purposes no flow. It is also interesting to note that both the DPPD and the carbon black, both of which are known free radical inhibitors, decreased the irradiation efficiency somewhat. Although this was also noted in subsequent experiments, it will be shown that most of the antioxidant was not affected during the irradiation. As the polymer becomes increasingly cross-linked, it can store ever increasing amounts of shear energy in passage through the extrusion die and this is reflected in higher values of plastic recovery. In a later part of this paper it will be shown that doses somewhat greater than 8 million reps are required to obtain optimum physical properties. The often repeated phrase that irradiation of a finished product is the most feasible method of utilizing this energy seems to be substantiated here since it is difficult to visualize how these materials could be processed if they were irradiated with doses of the order of 8 million reps.

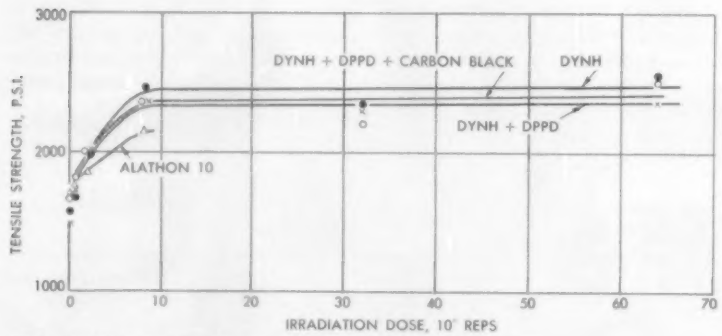


Fig. 1: Ultimate tensile strength versus irradiation dose

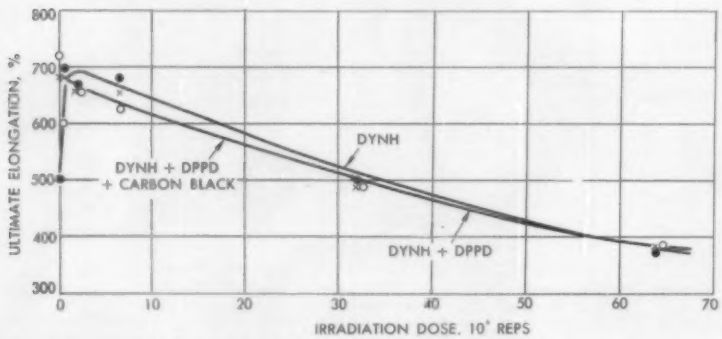


Fig. 2: Ultimate elongation versus irradiation dose

Tensile strength and elongation: The tensile properties were evaluated following the procedure outlined in A.S.T.M. D 412 using specimen die *C* and molded sheet 0.075 in. thick. As the irradiation dose was increased, tensile strength increased rapidly (Fig. 1, left) up to an irradiation dose of 8 million reps; thereafter, it remained fairly constant over the range studied. This increase in tensile strength lends further credence to the cross-linking theory since this behavior pattern is typical of polyethylenes of increasing molecular weight. It has been demonstrated, however, by workers in the field(9) that a decrease in tensile strength begins to appear at approximately the 80 million rep level. In this and subsequent studies it will be noted that Alathon 10 was not irradiated further than the 8 million rep level. This was solely due to equipment-time limitations. The elongation as shown in Fig. 2, left, appears to reach a maximum at relatively low doses and then declines at a fairly steady rate as the polymer becomes increasingly

Table III: Tensile strength at 100% elongation and tear resistance

Material	Irradiation dose, 10^6 reps	Tensile strength at 100% elongation (S-100), p.s.i.	Tear resistance, lb./in.
Alathon 10	0	1730	650
	½	1740	680
	2	1800	680
	8	1730	720
DYNH	0	1570	600
	½	1500	595
	2	1470	590
	8	1490	590
	32	1520	595
	64	1650	575
DYNH + DPPD	0	1450	555
	½	1550	610
	2	1540	595
	8	1550	605
	32	1550	600
	64	1630	560
DYNH + DPPD + Carbon black	0	1560	575
	½	1620	595
	2	1580	600
	8	1590	620
	32	1590	590
	64	1630	595

Table IV: Environmental stress-cracking of polyethylenes

Material	Irradiation dose, 10^6 reps	F-50[a], hr.
Alathon 10	0	0.3
	½	0.3
	2	1.5
	8	NF[b]
DYNH	0	0.3
	½	0.3
	2	26
	8	504
	32	NF[b]
	64	NF[b]
DYNH + DPPD	0	0.3
	½	0.3
	2	4.5
	8	504
	32	NF[b]
	64	NF[b]
DYNH + DPPD + Carbon black	0	0.3
	½	0.3
	2	2.5
	8	504
	32	NF[b]
	64	NF[b]

[a]F-50 = time for one-half of the specimens tested to fail.

[b]NF = No failures, 3 months.

elastic and less plastic in nature. It has been reported that at a dose of 120 million reps the elongation at break is 130 percent(9).

Another conveniently measurable tensile property determined was the tensile strength at 100% elongation. Over the range measured this value appears to increase only slightly (Table III, above.), indicating an increase in molecular weight due to cross-linking. However, it has been reported that at higher doses ($> 150 \times 10^6$ reps), as the polymer becomes more and more elastic and crystallinity decreases, this value increases quite rapidly, approaching values predicted by the theoretical relation for rubber elasticity(9).

Tear resistance: Tear resistances were measured by the method outlined in A.S.T.M. D 1004 and are tabulated in Table III. As would be anticipated for a test of this nature, which involves nicking of specimens, the tear resistance remained quite constant over the range studied. Since the test as described in the method is really a measure of only rather large structural differences (e.g., large difference in crystallinity), it is not surprising that up to a dose of 64 million reps no changes in tear resistance were noted.

Environmental stress-cracking: This test was performed by the proposed A.S.T.M. test procedure(16), which consists of exposing bent specimens of the material having a controlled imperfection on one surface to the action of a surface active agent, Igepal CO-630. All of the materials tested behaved quite similarly (Table IV, left). At relatively low doses (below 2 million reps) there did not appear to be significant changes in resistance to stress-crack failure. However, at doses over 8 million reps the polyethylenes became essentially crack-resistant. From the results of these experiments it would appear that 8 million reps is very close to an optimum practical dose for obtaining complete crack-resistance for these polymers. Unfortunately, no data were obtained for doses between 8 and 32 million reps. It appears that as the polymer becomes increasingly cross-linked, it becomes increasingly difficult to induce stress-crack failures.

Deformation under load: Disks

Table V: Deformation under load of DYNH polyethylene

Irradiation dose, 10^6 reps	Decrease in thickness: 95°C., %	105°C., %	110°C., %	115°C., %	120°C., %	130°C., %
0	0.3	22.7	—	—	—	—
½	1.8	24.2	—	—	—	—
2	1.3	18.5	61.3	—	—	—
8	0.8	13.1	37.9	41.2	41.0	33.6
32	0.5	5.1	3.9	3.2	3.7	3.5
64	0.8	2.0	0.4	0	0	0

Table VI: Density at 23° C. of irradiated polyethylenes

Material	Irradiation dose, 10^7 reps	Density
DYNH	0	0.9190
	½	0.9191
	2	0.9190
	8	0.9192
	32	0.9205
	64	0.9208
DYNH + DPPD	0	0.9195
	½	0.9192
	2	0.9191
	8	0.9196
	32	0.9206
	64	0.9211
Alathon 10	0	0.9230
	½	0.9229
	2	0.9230
	8	0.9231

of 0.256-in. diameter were compressed in a parallel plate plastometer at test temperatures ranging from 95 to 130° C. and the percent decrease in thickness measured. Since the previous experiments had shown that all the materials included in this program behaved quite similarly, tests were run only on the DYNH samples. The results (Table V, p. 131) demonstrate quite clearly that as the irradiation dose increases and the polymer assumes an ever increasing three-dimensional gel structure, its tendency to deform under load at temperatures above the softening range becomes negligible. In fact, it has been reported that a sample irradiated to a dose of 64 million reps exhibited no viscous flow in this test at 210° C.(10). Similarly, we found that a sample of DYNH irradiated to a dose of 32 million reps did not flow through the extrusion plastometer even when heated to 267° C. A three-fold increase in load at this temperature also failed to cause any plastic flow. Examination of the material removed from the extrusion plastometer revealed it to be only partially fused. From the results obtained at temperatures below the softening range of the polymer, it is probable that concomitant plastic and elastic contributions are important. There can be little doubt that at sufficiently high irradiation doses an appreciable improvement in heat distortion is brought about.

Density: The densities reported (Table VI and Fig. 3, below) were measured by the method outlined in the "Proposed method of test for the measurement of density of plastics by the density-gradient technique," prepared in A.S.T.M. Committee D-20 on Plastics. The method, which is being used extensively, is known to give results accurate to better than 0.05 percent. It is felt, therefore, that differences of greater than four in the fourth decimal place are significant. From these results it is apparent that up to a dose of 8 million reps there was no change in density of the polymer, but as the dose was increased a definite trend towards higher densities was seen. Although this increase in density is small and it is known to reach a maximum and then decrease, it is a significant change. Presumably at relatively low doses of irradiation the introduction of relatively few cross-links does not affect the density of the polymer. As the dose is increased, increasing cross-linking, most of which must be occurring in the amorphous area, together with the loss of hydrogen and the concomitant increase in unsaturation can account for the increase in density. It is also possible that enough chain scission occurs in the amorphous area to cause an increase in crystallinity due to a random build-up of crystallites. It has been demonstrated that at very high doses (3×10^9 reps) the crystalline areas are completely destroyed (17).

Accelerated weathering: The samples were weathered in a modified X-1-A accelerated weathering unit (18) and polymer degradation was followed by measurement of low-temperature brittleness as described in A.S.T.M. D 746. Analysis of results (Table VII and Fig. 4, p. 134) indicates that the irradiated samples should weather better than the unirradiated material. It is recognized, however, that low-temperature brittleness is only one criterion of weathering, albeit an important one in cable engineering. The improvement in weathering due to irradiation is undoubtedly due to the cross-linking reaction which causes enormous increases in molecular weight even at relatively low doses. This is consistent with theory since low-temperature brittleness is a function of molecular weight. At relatively low doses, it appears that this increase in molecular weight overcomes the deleterious weathering effects due to increased unsaturation. However, as the irradiation dose is increased there does not appear to be any proportional increase in weathering, probably due to ever increasing unsaturation.

The sample containing carbon black has not at this writing shown enough change to warrant comment here. However, results of previous experiments at the Laboratories indicate that samples of weather-resistant black polyethylene compound when ir-

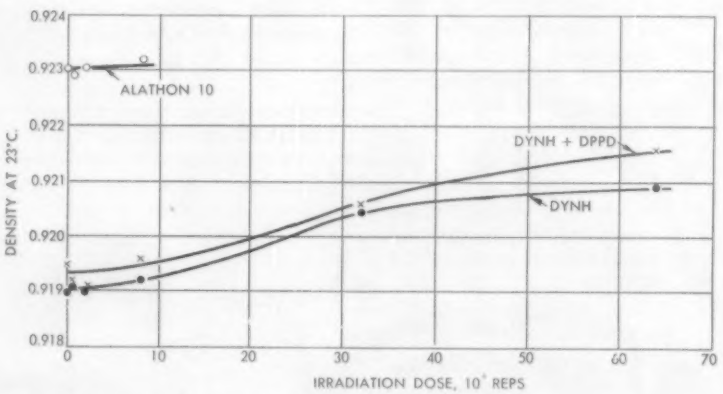


Fig. 3: Density versus irradiation dose

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radiated to doses of 8 to 16 million reps show appreciable improvement in weatherability as measured by low-temperature brittleness. It is also interesting to note that the sample of DYNH containing DPPD weathered far better than the unprotected samples. Since the results of the experiments reported here showed little differences in physical properties between the sample containing DPPD and the unprotected sample, it is reasonable to assume the antioxidant was not appreciably affected by irradiation.

Electrical properties

Dielectric constant and dissipation factor: For frequencies below 1 mc. all dielectric measurements were made using the "fluid displacement method"(19). This is a differential method in which a liquid of accurately known dielectric constant and loss is placed in a parallel-plate condenser and measurements of capacity and conductance are made and compared with values obtained when the material is placed in the cell and displaces some liquid. It is also necessary that the dielectric constant and loss of the liquid be quite close to that of the material being measured. The data reported here (Table VIII and Fig. 5, p. 136) were obtained with benzene. The method, which is quite accurate, cannot be used with any degree of accuracy at test frequencies over 1 mc. in its present stage of development, and it was therefore necessary to make 60-mc. determinations by the resonant-circuit susceptance-variation method described in A.S.T.M. D 150 using tinfoil electrodes on the test disks. Since this method is not as accurate as the fluid displacement method, values for dielectric constant at 60 megacycles are reported to only three significant figures.

Analysis of the data reveals that at any irradiation dose both dielectric constant and loss remain essentially constant over the frequency spectrum measured. At any one frequency, however, as the irradiation dose is increased the dielectric constant and the loss increase slightly. The accuracy of the determinations is such (0.1% for dielectric constant measurements and ± .0001 for loss measurements) that these changes are significant. The increase in dielectric constant probably cannot wholly be accounted for by the concomitant increase in density reported earlier nor by increased unsaturation. The increase in loss, which is quite sensitive to the introduction of polar groups (e.g., carbonyl), indicates that it is very probable that some polar groups are introduced into the molecule during irradiation. Small amounts of dissolved oxygen or oxygen impurity in the nitrogen atmosphere used during these irradiations could partially account for the increase in dielectric constant and loss. Irradiation, however, appears to have little affect on the dielectric properties of polyethylene.

Table VII: Effect of accelerated aging on low-temperature brittleness

Material	Irradiation dose	T_B (50% brittle point) after artificial aging					
		0 hr.	8 hr.	16 hr.	25 hr.	40 hr.	55 hr.
	10^6 reps	°C.	°C.	°C.	°C.	°C.	°C.
DYNH	0	<−75	<−75	−72	−17	−35	+5
	½	<−75	<−75	−57	−50	−31	−20
	2	<−75	<−75	−56	−55	−28	−13
	8	<−75	<−75	−54	−20	−29	−14
	32	<−75	<−75	−44	−35	−17	−7
	64	<−75	<−75	−52	−39	−16	−14
DYNH + DPPD	0	<−75	<−75	−74	−72	−57	−13
	½	<−75	<−75	<−75	−54	−47	−23
	2	<−75	<−75	<−75	<−75	<−75	−24
	8	<−75	<−75	<−75	<−75	−58	−32
	32	<−75	<−75	<−75	−62	−48	−34
	64	<−75	<−75	<−75	<−75	−39	−35
Alathon 10	0	<−75	<−75	−67	−22	−33	+10
	½	<−75	<−75	−55	−53	−32	−7
	2	<−75	<−75	−55	−57	−33	−7
	8	<−75	<−75	−57	−40	−33	−5

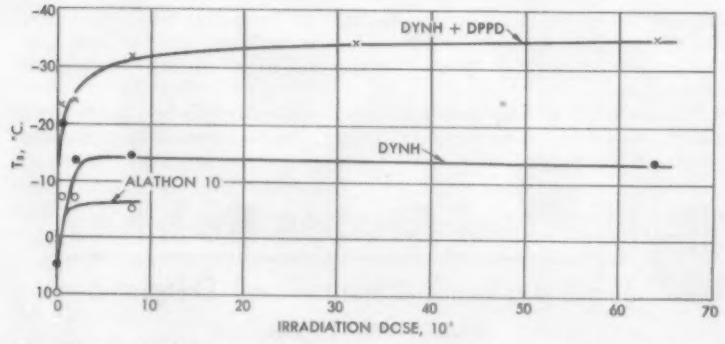


Fig. 4: T_B (50% brittle point) versus irradiation dose after 55 hr. of artificial weathering

Conclusions

The results reported here, some of which have been reported previously, present a rather interesting picture. Starting with a standard grade polyethylene or perhaps one of even lower molecular weight, it is possible by a judicious selection of irradiation dose 1) to effect a marked increase in tensile strength without any significant loss in elongation, 2) to convert a material of poor crack resistance to one which has complete crack resistance, 3) to markedly improve the heat distortion of the polymer, and 4) to improve its weathering character-

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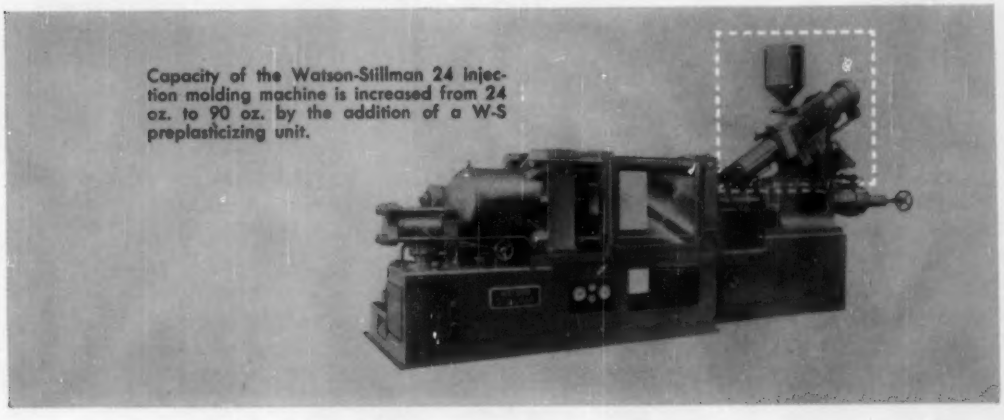
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istics. All these beneficial improvements can be brought about without any significant loss in the excellent dielectric properties of polyethylene. It also appears that the addition of various essential ingredients (i.e., carbon black and antioxidant) did not appreciably affect the irradiation efficiency nor presumably were the additives adversely affected. Further study is, however, necessary to elucidate the effect of different additives under varying conditions.

This study indicates that at a dose of somewhere in the range of 8 to 16 million reps optimum properties can be obtained. While it is true that at present the most practical use of the irradiation process is on finished products, the recent strides made in the development and manufacture of better electron-accelerator type equipment makes this a commercially feasible process. Whether or not the process is at this time economical must be answered by the individual manufacturer.

The author expresses his appreciation to Miss E. E. Sandmeyer and C. R. Glenn for obtaining the data on physical properties; to D. B. Herrmann, who made the dielectric measurements; and to Dr. W. L. Brown and W. M. Augustyniak, who performed the irradiations.

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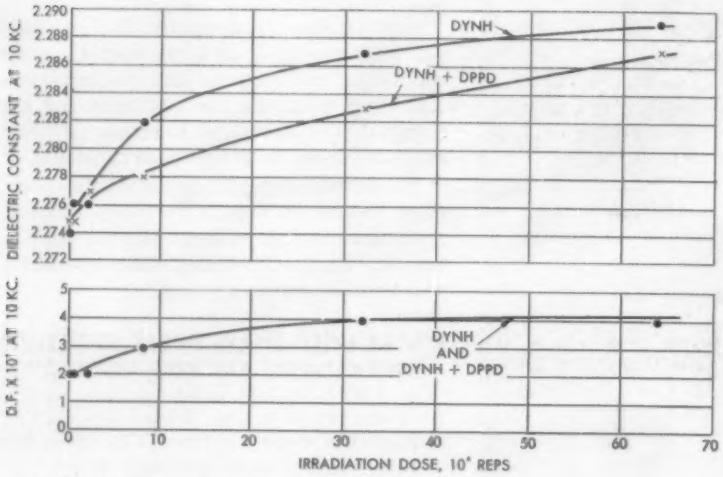


Fig. 5. Dielectric constant and dissipation factor at 10 kc. versus irradiation dose

Table VIII: Dielectric constant and dissipation factors at various frequencies

Material	Irradiation dose, 10^6 reps	Dielectric constant: 1 kc.	10 kc.	100 kc.	830 kc.	60 mc.	Dissipation factor × 10^4: 1 kc.	10 kc.	100 kc.	830 kc.	60 mc.
DYNH	0	2.276	2.274	2.277	2.277	2.27	1	2	<1	1	3
	½	2.276	2.276	2.277	2.278	2.27	4	2	<1	2	4
	2	2.277	2.276	2.278	2.278	2.27	4	2	1	2	4
	8	2.283	2.282	2.282	2.283	2.28	4	3	2	4	7
	32	2.289	2.287	2.286	2.285	2.28	4	4	2	4	7
	64	2.291	2.289	2.288	2.287	2.29	4	4	3	4	7
DYNH + DPPD	0	2.276	2.275	2.275	2.277	2.27	2	2	<1	1	2
	½	2.276	2.275	2.276	2.277	2.27	3	2	<1	2	3
	2	2.277	2.277	2.276	2.277	2.28	3	2	1	2	4
	8	2.279	2.278	2.277	2.279	2.29	3	3	1	2	3
	32	2.283	2.283	2.282	2.281	2.28	4	4	2	3	4
	64	2.288	2.287	2.284	2.285	2.27	4	4	2	4	5
Alathon 10	0	2.280	2.281	2.280	2.282	2.29	2	2	<1	1	2
	½	2.282	2.283	2.281	2.283	2.29	3	2	<1	1	3
	2	2.281	2.283	2.280	2.283	2.29	2	2	<1	1	3
	8	2.283	2.285	2.283	2.283	2.29	2	2	1	2	3

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VALUES RELATING TO FABRICATION	**VND-9950**	**VND-9960**	**VND-9970**	**VND-9980**	**VND-9734**	**VND-9938**	**QND-5590**	**QND-5568**
Stock Temp., deg. F.	320-350	320-350	320-350	320-350	320-340	320-350	320-350	330-360
Plunger Pressure, psi	7000-9000	7500-9500	8000-10,000	10,000-12,000	7500-9500	8000-10,000	9000-11,000	7500-9500
Mold Temp., deg. F.	100-110	100-110	100-110	100-110	100-110	100-110	100-110	100-110
Diced Particle Size	Nominal 3/16 in.	Nominal 3/16 in.	Nominal 3/16 in.	Nominal 3/16 in.	Nominal 3/16 in.	Nominal 3/16 in.	Nominal 3/16 in.	Nominal 3/16 in.
Specific Gravity (D792-50 Method A)	1.31*	1.32*	1.35*	1.37*	1.35*	1.32*	1.38*	1.25*
VALUES FROM MECHANICAL TESTS								
Tensile Strength (D412-51T), psi	1500	1750	2100	2500	1450	1800	2300	1750
Ultimate Elongation (D412-51T), per cent	390	335	340	300	335	310	250	300
Durometer Hardness (D676-49T), Shore Type "A", 15 sec. reading	50	60	70	80	60	60	90	68
Brittle Temperature (D746-55T), deg. C., 50 per cent non-failure	—40	—36	—30	—25	—28	—10	—20	—30
Stiffness (D1043-51), psi 25 deg. C.	400	500	800	1800	550	560	3000	750
0 deg. C.	900	1200	4500	22,000	1400	10,000	45,000	3200
—25 deg. C.	4700	10,000	56,000	160,000	20,000	225,000	210,000	58,000
—50 deg. C.	122,000	250,000	350,000	425,000	220,000	480,000	465,000	285,000
VALUES FROM MISCELLANEOUS TESTS								
Water Absorption (D570-54T), per cent, .070 in. specimen	0.20	0.20	0.20	0.20	0.20	0.40	0.20	0.25
Soluble Matter Lost (570-54T), per cent, .070 in. specimen	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.05

*Varies slightly with color

advantages



The "Economy" Vinyl

VND-9734 is a low-cost, opaque, injection-molding vinyl-chloride-acetate material, for use where economy is the primary consideration. Its excellent chemical resistance is demonstrated in its use for distributor nipples, where it resists attack by ozone, and for beach clog straps, where it withstands the effects of soap and water. A limited range of colors is available.



A "Non-migrating" Vinyl

Since **VND-9938** is non-migratory and non-marring, articles molded from it can be in continual contact with other plastics and coated surfaces, with no transfer of plasticizer. These toilet seat bumpers demonstrate such a use for this vinyl chloride-acetate injection molding material. It also has low volatility and excellent resistance to oils, and comes in a variety of colors.



A Tough, Easily Molded Vinyl

With Durometer 90 hardness, **QND-5590,** a polyvinyl-chloride material, is one of the more rigid elastomers. It is formulated to give excellent mold fill-out at relatively low cylinder temperatures and plunger pressures. The toughness of this material is one reason why it is used for these feet and plugs for folding chairs. Another reason is that the non-warping, accurate dimensions assure a permanent fit.



A Vinyl for Large Moldings

Where applications involve large molds, **QND-5568** is particularly useful. This opaque, polyvinyl-chloride injection molding compound is formulated to give excellent mold fill-out at relatively low cylinder temperatures and plunger pressures. Finished pieces possess high gloss, scuff resistance, toughness, and durability. This material is also noted for its low-temperature flexibility. Luggage handles are a good example of applications that take advantage of these properties. The one shown here is molded around a steel core and will support 400 lbs.

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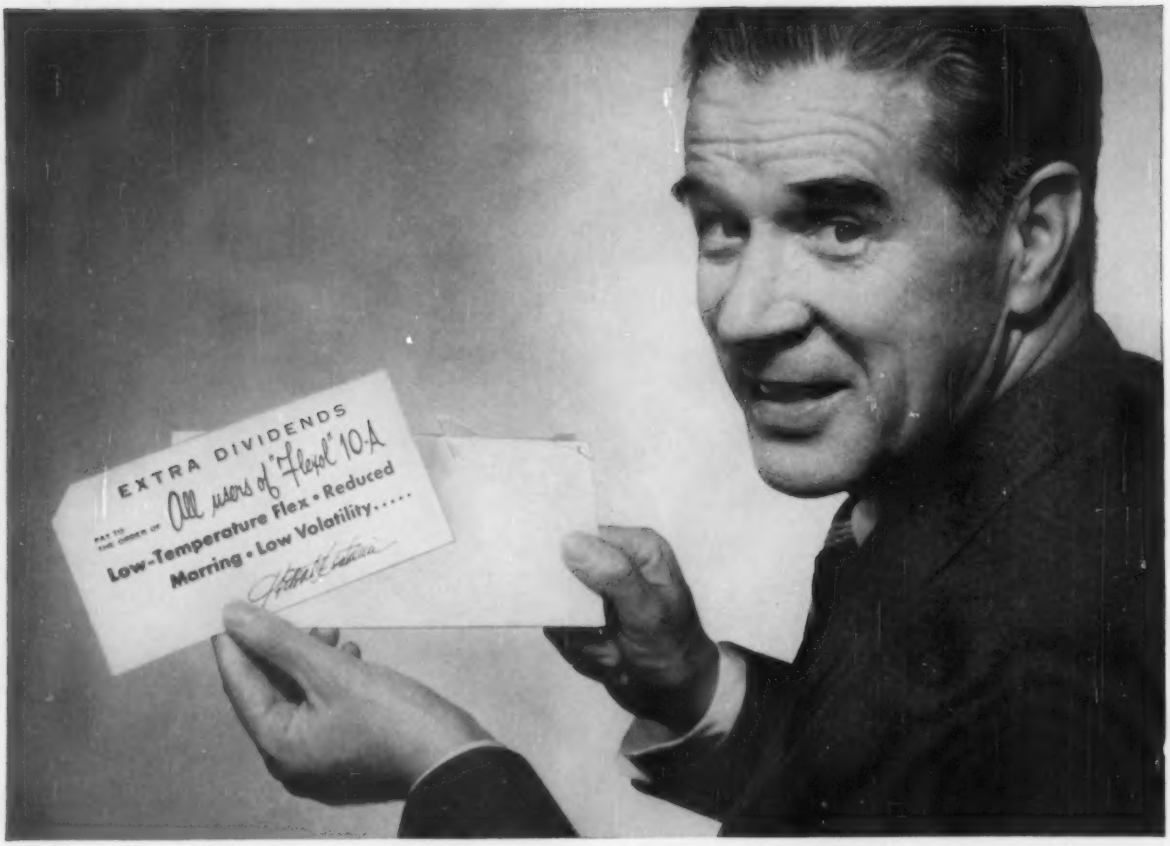
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Application of the superposition principle to data on

Heat-aging of plastics

*By C. D. Doyle**

Two serious difficulties are usually encountered in determining the life-temperature characteristics of plastics on the basis of the conventional destructive mechanical tests. One, of course, is broad data scatter. The other arises out of the fact that the useful engineering properties of solid plastics seldom degrade in a simple, regular fashion. This is especially true of reinforced plastics. The use of non-destructive testing provides a way around these difficulties (1),[1] but where such methods are unavailable or where it is desirable to compare conventional data with non-destructive test findings, the twin difficulties of data scatter and irregular decay process remain to plague the investigator. The ever-insufficient data usually hint of peaks and valleys in the property-versus-time curves, but the question whether they are real remains unsettled. Worse still, completely erroneous extrapolations are sometimes drawn down a slope which may, in reality, turn up toward a new peak or level off.

Fortunately, there is a way around this difficulty too. The procedure is based on the superposition principle, or, as it is also known, the method of reduced variables. In effect, superposition marshals the data for several aging temperatures into one master aging curve at a single reference aging temperature. The resulting master curve then contains so many data points that peaks and valleys are quite clearly defined. The superposition principle has been applied to studies of the dynamic mechanical behavior of polymers (2,3) and to stress relaxation studies (4,5). In these applications superposition permitted the description of complete master curves, which in parts were experimentally inaccessible.

*General Engineering Laboratory, General Electric Co.

[1]Numbers in parentheses link to references at end of article, p. 213.

Procedure

In applying the superposition principle to thermal aging data, one of the actual aging temperatures is selected to serve as the single reference temperature. Usually the reference temperature is chosen from the middle of the experimental range of aging temperatures in order to reduce error. Preferably the aging temperatures are expressed as reciprocal absolute values and the temperature nearest the middle of the resulting range is selected for reference.

Next, it is necessary to derive a set of scale factors to convert test times at each aging temperature to equivalent times at the central reference temperature. If the time-rate of aging is uniquely dependent upon aging temperature, the conversion of actual times to equivalent times at the reference temperature can be readily accomplished by multiplying each observed time period at each aging temperature by the appropriate scale factor for that aging temperature.

For example, in one of the case

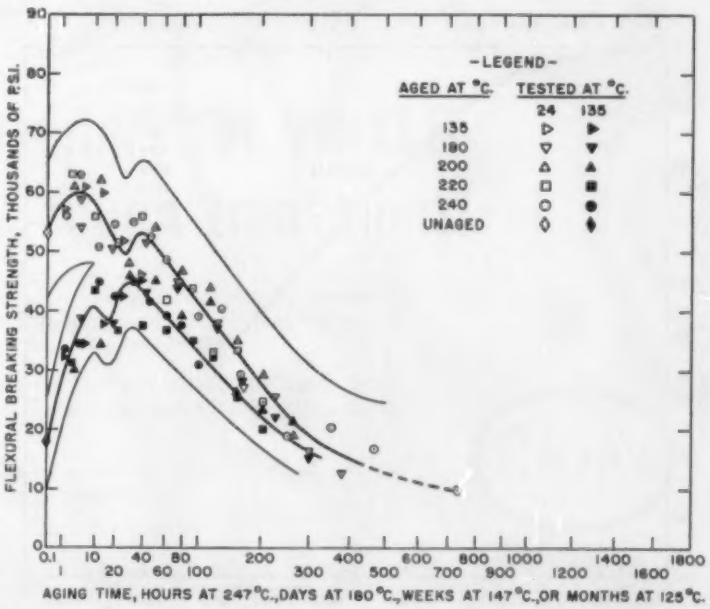


Fig. 1: Flexural breaking strength of TAC laminate versus aging time. (Heavy lines are average values, light lines observed data scatter)

histories to be presented later, it turned out that a day at 240° C. was equivalent to 16.7 days at 180° C., the reference temperature. Thus, each time samples were broken during the aging history at 240° C., the elapsed aging time was noted in the usual way, then multiplied by 16.7 to convert to equivalent time at 180° C.

The scale factor, which is usually called a_τ or a_T, can be derived for each aging temperature, either directly from the data or on the basis of additional information. In the case of aging data that are expressed in terms of destructive tests (such as flexural strength or dielectric strength), the scatter is usually too broad to permit deriving a_τ directly. The additional information needed is gained by conducting more reproducible, non-destructive tests along with the destructive tests of interest. Suitable collateral non-destructive tests include weight-loss and low-amplitude vibration measurements (1). It is assumed that the same temperature-dependence is shown for the rate processes governing the degradation, whether probing is conducted by mechanical, electrical, or chemical tests.

The data from the non-destructive tests will usually yield a fairly good approximation of the rate constant, K, for each aging temperature. Failing this, the data will provide at least an estimate of an inverse function of the rate constant, in terms of the elapsed time, τ_f, required to reach a certain level of deterioration. The scale factor, a_τ, can be calculated directly from the values of K or τ_f:

$$a_\tau = K_t/K_0 = \tau_{f0}/\tau_{ft} \qquad \text{Eq. 1}$$

where the subscripts "t" and "o" refer to the aging temperature of interest and the reference temperature, respectively.

Equation 1 may be used to compute a_τ even in cases wherein the life-temperature data yield a non-linear Arrhenius plot (log K or log τ_f versus reciprocal absolute temperature). The resulting superposition is not valid, however, unless the same life-temperature relationship holds throughout the aging history. Whether this is the case can best be shown by superposing the non-destructive test data. If they fail to superpose within reasonable limits, considering such accidental variables as oven temperature drift and oven failure, the assumption of an unchanging life-temperature relationship is invalid. The powerful effect of oven temperature drift should be clearly recognized before the conclusion is reached that superposition is impossible. In some instances, a drift of as little as 1° C. introduces tremendous errors in long-time data.

If the life-temperature data for the non-destructive test program yield a linear Arrhenius plot, the scale factor can be calculated on the basis of the Arrhenius rate equation:

$$a_\tau = Ae^{-E/RT_t}/Ae^{-E/RT_o} \qquad \text{Eq. 2}$$

where A is the apparent frequency factor, E is the apparent activation energy for the degradation, R is the molar gas constant, T is temperature in °K., and the subscripts "t" and "o" have the meaning assigned for equation 1. Equation 2 reduces to:

$$\log a_\tau = \frac{E \log e}{R}\left(\frac{1}{T_o} - \frac{1}{T_t}\right) \qquad \text{Eq. 3}$$

where E is in cal. and R is in cal./mole, °K. The quantity (E log e)/R is the slope of the plot of log τ_f or log K versus 1/T.

Table I: Superposition time-scale factors for TAC Laminate

Aging temperature	a_τ
° C.	
135	0.067
180	1.00
200	3.14
220	9.18
240	16.7

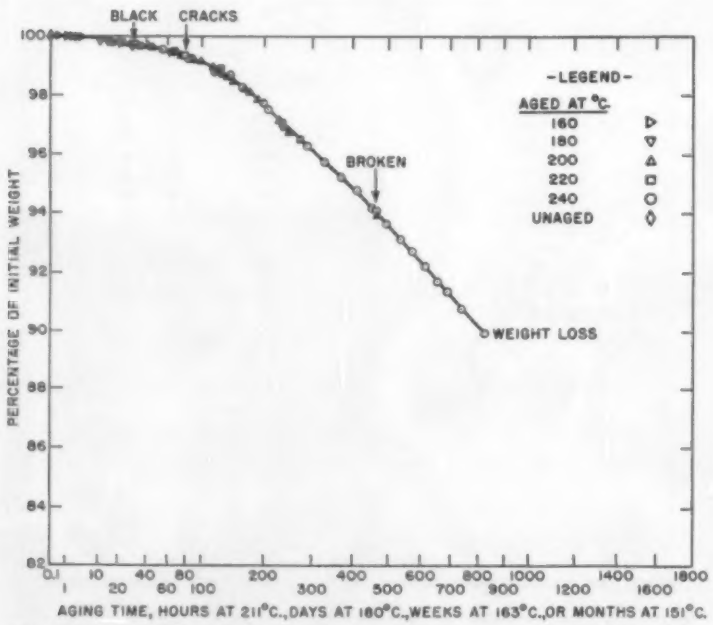


Fig. 2: Weight loss of HE laminate versus aging time

Illustrative examples

TAC laminate: A previous publication (1) reported the use of low-amplitude vibrational testing as a non-destructive means of evaluating the extent of degradation in laminate made with a triallyl cyanurate-glycol maleate polyester and glass cloth (hereinafter called TAC laminate) during heat-aging in air at 180, 200, 220, and 240° C. This work yielded a set of rate constants for the thermal degradation of this material together with a least squares apparent activation energy of 22.6 kcal. Subsequent work has afforded an additional rate constant, corresponding to an aging temperature of 135° C. The recalculated

(*To page* 146)

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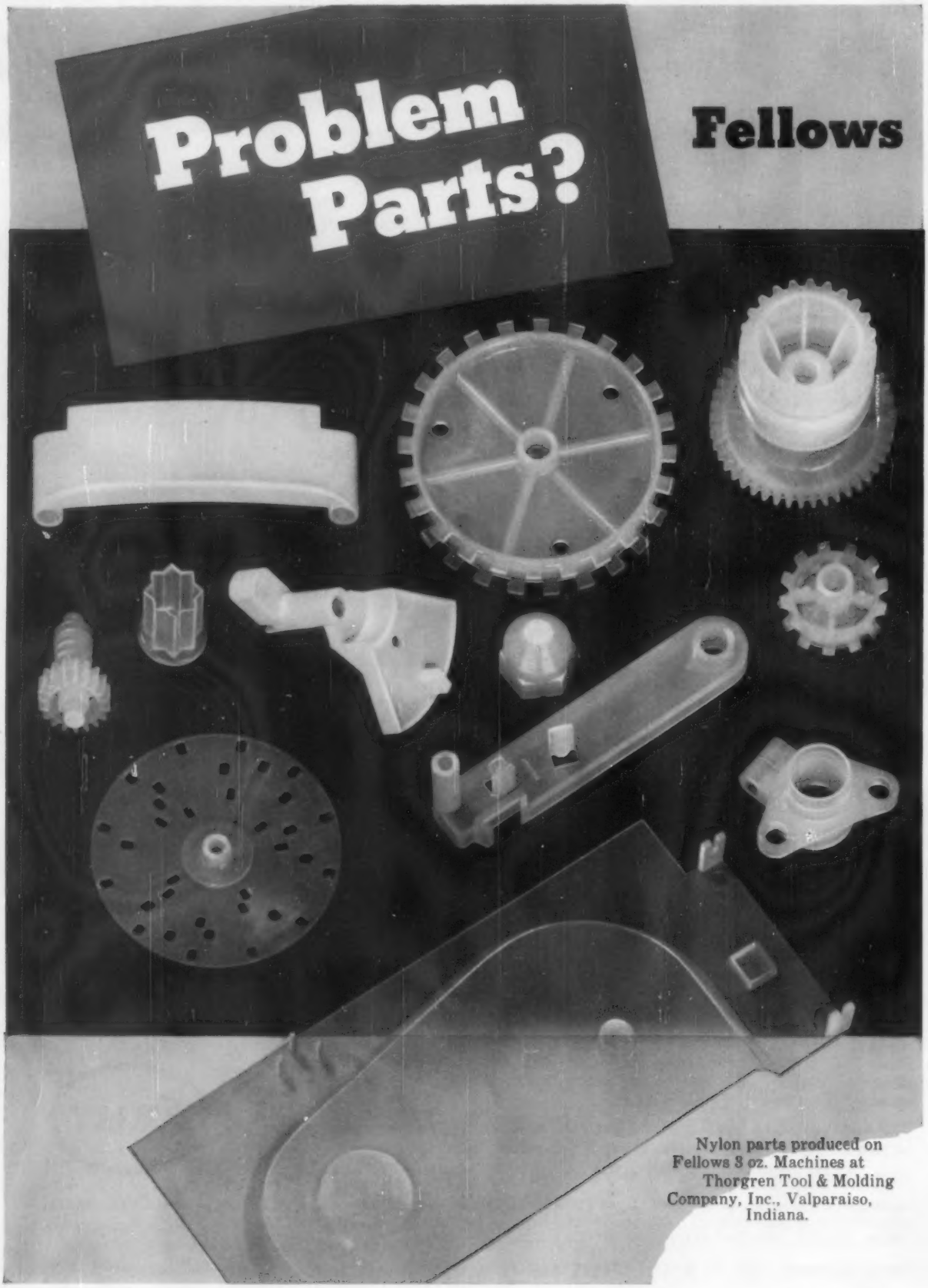
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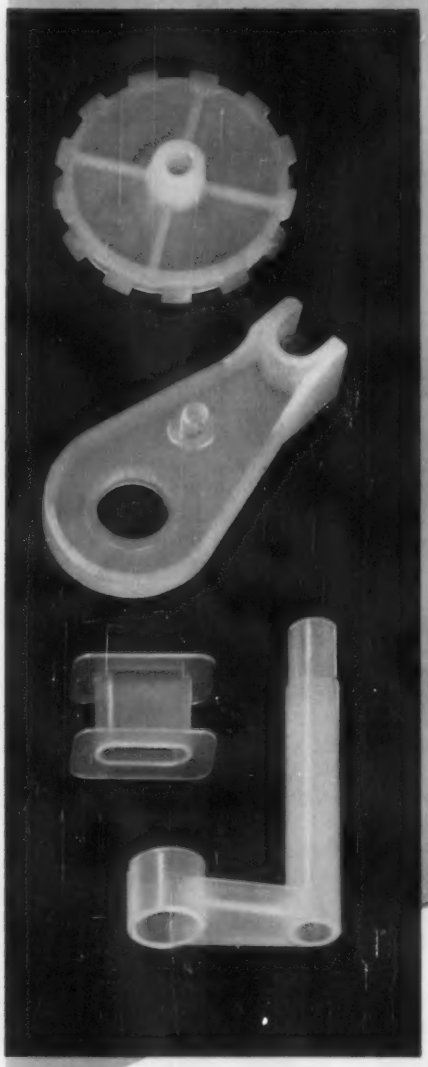
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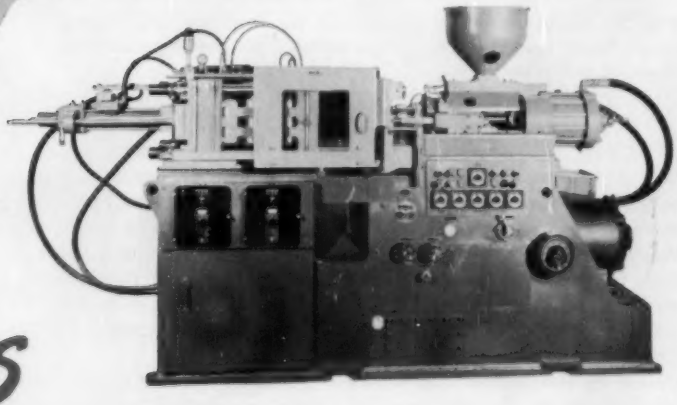
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apparent activation energy was 22.1 kcal. Choosing 180° C. as the central reference temperature, and substituting 22.1 kcal. into equation 3:

$$\log a_T = 4.821 \left(2.208 - \frac{10^3}{T_t} \right) \quad \text{Eq. 4}$$

The scale factors for superposition, given by equation 4, are listed in Table I, p. 142.

During the aging of the TAC laminate, specimens were broken in flexure from time to time at 24° C., 50% relative humidity and at 135° C., using a cross-head speed of 0.05 in./min. Specimens were broken in groups of only 3. The averages of the groups of 3 specimens were broadly scattered, so that very little could be deduced from the separate plots of flexural strength versus time at each aging temperature. When the actual time-periods, in days, were multiplied by the appropriate values of a_T, however, the data yielded the well-populated plots, shown in Fig. 1, p. 141. All the data of the program are thus applied to the single problem of describing the shape of the property versus time curve.

To anyone who is accustomed to highly precise measurements, the degree of superposition in Fig. 1 leaves much to be desired. However, considering that the lightly drawn lines in Fig. 1 indicate the breadth of scatter observed in the case of the individual data points, the superposition is quite good. More importantly, the clustering of points at peaks and valleys and along linear portions of the plots renders these features credible.

It will be noted that in order to increase the usefulness of Fig. 1, the equivalent time-scales are given not only in days at 180° C., the reference temperature, but also in hours, weeks, and months at appropriate temperatures. These appropriate temperatures are found by setting log a_T equal to log 24 (for hours), log 1/7 (for weeks), or log 1/30.4 (for months) and solving for T_t in equation 4.

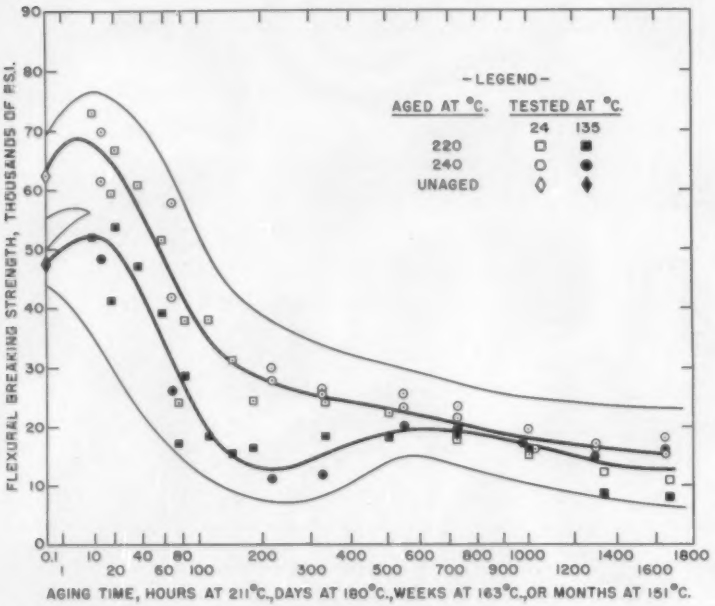


Fig. 3: Flexural breaking strength of HE laminate versus aging time. (Heavy lines indicate average values; light lines represent the observed data spread)

HE laminate: Another laminate system studied comprised glass cloth and an epoxy resin, hardened with hexachloro-endo-methylene-tetrahydrophthalic anhydride (hereinafter called HE laminate). In this case collateral information was gained from weight-loss studies of the clear resin at 160, 180, 200, 220, and 240° C. Exceptional care was taken to control oven temperatures throughout the entire program, and interlopers were constrained from frivolously opening the oven doors. The weight-loss study yielded a linear Arrhenius plot which, in turn, provided a least squares apparent activation energy of 44.6 kcal. for the degradation. Substituting this value into equation 3, and again choosing 180° C. as the central reference temperature:

$$\log a_T = 9.748 \left(2.208 - \frac{10^3}{T_t} \right) \quad \text{Eq. 5}$$

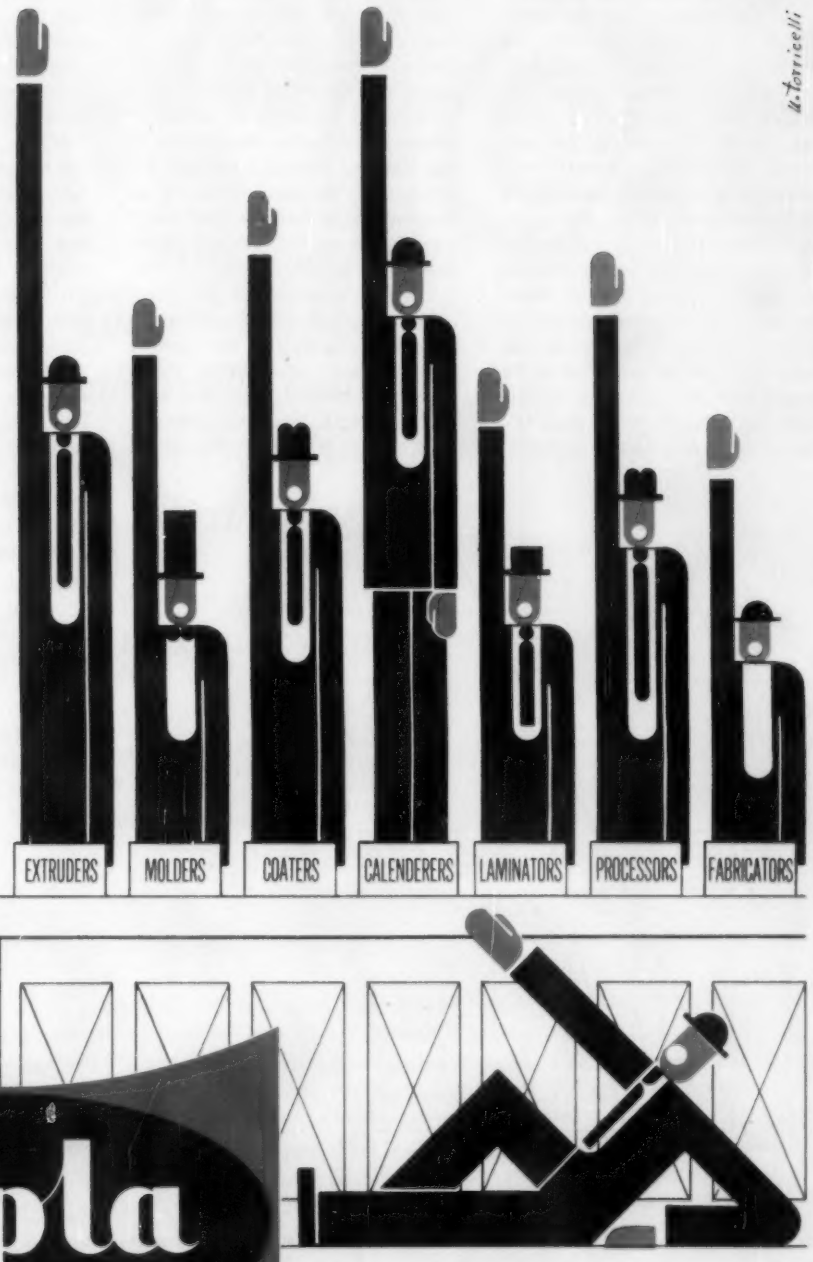
It is easily seen from equation 5 that a very small oven-temperature drift can produce a large error in the value of a_T and an even larger error in reduced values of long-time aging periods. However, as a result of the precautions taken to reduce temperature error during aging, and after corrections were applied to drifted temperatures, the superposition of the weight-loss data was quite good, as shown in Fig. 2[2], p. 142. Oven-temperature corrections were made on the basis of the 44.6 kcal. apparent activation energy noted earlier.

Flexural specimens of HE laminate were aged, again in groups of only 3 replicates and, in this case, only at 220 and 240° C. For purposes of easy comparison, however, 180° C. was again selected as the reference temperature. The average values of flexural strength are plotted against reduced time in Fig. 3. Again, advantage has been taken of all the data points to describe the shapes of the decay curves.

Modes of deterioration

The value of such clear delineation of the shapes of property versus time curves goes beyond increased accuracy of extrapolation. Consideration of the shapes of the curves, together with microscopic examination of the specimens, lead to a clearer understanding of the gross processes involved in the degradation. The TAC laminate, for example, was far from cured, as received, as shown in Fig. 1 by

[2] In Fig. 2 the weight-loss data for clear resin have been presented on the laminate basis, assuming 70% glass by weight.



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the initial peaks and by the marked increase in hot-strength during aging. The reason for this is that the samples were prepared a few years ago when the techniques of handling this material had not yet been well established. Improper preparation may also explain why the TAC laminate was poorly integrated, as evidenced by its dry, "woody" appearance, and by the tendency of the material to fail by delamination in flexure throughout the aging program. The valleys which are clearly present in the decay curves have been attributed to internal stress-build-up, as the resin attempts to compensate for weight-loss by shrinking within itself and away from the glass (1). The subsequent peaks occur as the internal stress relieves. No tenable reason has been offered to explain why the peaks at room temperature and at 135° C. are mutually out of phase.

The linear decay process has been attributed to Fickian diffusion because the weight-loss data were also linear with the square root of time (1). However, any process is linear with the square root of time if the process rate is inversely proportional to the magnitude of the property undergoing change. Thus, it might be postulated that the strength of the laminate is proportional to the concentration of intact resin-resin and resin-glass bonds, so that the rate of decrease of the concentration of useful bonds and, therefore, of flexural strength is inversely proportional to the magnitude of the flexural strength at any instant. The eventual level-off of flexural strength of the TAC laminate is known to be due to gross delamination (1).

The HE laminate, on the other hand, was well-cured and well-integrated, having a translucent, almost clear appearance. Some curing occurred initially, but flexural strength dropped precipitously only a little while later.

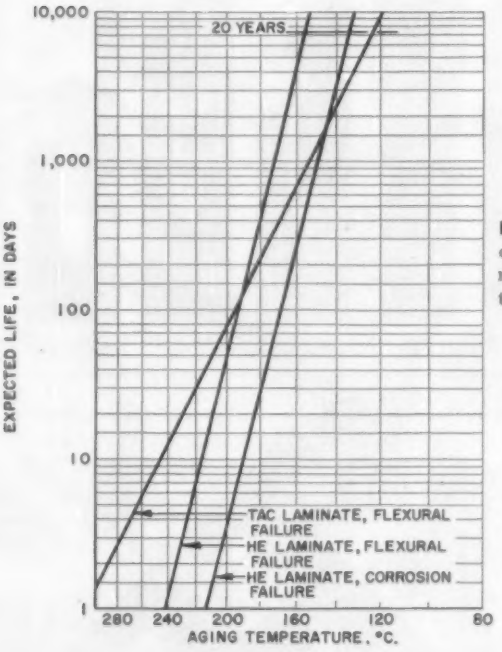


Fig. 4: Expected life of TAC and HE laminates versus aging temperature

Visual examination of the specimens and consideration of the shape of the weight-loss curve in Fig. 2 showed why this was so. The resin cracked into conchoidal fissures, which grew larger with increased aging, then remained fairly stable in size after about 150 equivalent days at 180° C.[3] Thus, the steeper slopes in the flexural strength curves for HE laminate reflect rapid loss of cohesive strength in the resin. Since the laminate was well integrated, the loss of resin strength caused the overall strength of the laminate to decrease proportionately. The later, more gentle slopes are akin to the linear portions of the TAC laminate plots, where regular loss of resin-resin and especially, resin-glass bonding is reflected. Gross delamination did not occur in the HE laminate, even in the late stages of aging. Throughout the aging history, examination of the flexural specimens showed that the predominant effect was tensile failure of the glass. No sound explanation has been offered for the peculiar, but real valley in the hot flexural data for HE laminate at about 250 equivalent days at 180° C.

Life-temperature relationships

Comparison of the time scales of Figs. 1 and 3, p. 146, shows that, in terms of retention of flexural strength, the TAC and HE laminates have approximately equivalent life-expectancies at about 180° C. However, at lower temperatures the HE laminate survives longer, while the TAC laminate is the better material at temperatures above 180° C.

It is always difficult to select a meaningful criterion of failure in a life test. In some quarters, failure is said to have occurred when the physical property of interest has declined to 50% of its initial value.

From a practical standpoint this criterion has little meaning, however. Many materials are still quite useful at this point. Moreover the initial value is hardly a sacred constant. In almost every aging program, postcuring improves the material, often quite markedly.

Perhaps, in the present case, a more sensible criterion of failure might be based on the fact that, although the failure mechanisms of the two laminates were quite different, the properties of both materials began to change more slowly when the flexural strength had declined to about 24,000 p.s.i. It might be argued that this value represents a threshold at which

(*To page* 213)

[3] This behavior is not characteristic of epoxy resins. Subsequent study showed that the loss of voluminous quantities of chlorine from the hardener was the cause of the tremendous shrinkage observed.

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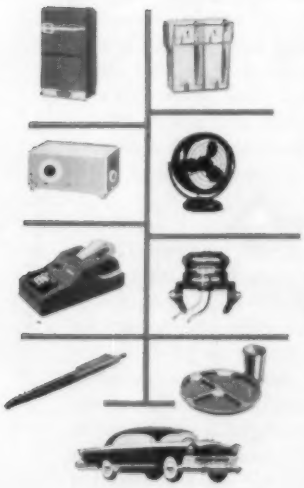
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General

Plastics growth rate slowing? Chem. Eng. News *35*, 96 (Apr. 8, 1957). A report on the growth of the plastics industry indicates that the growth rate is decreasing.

Colloids and surface behavior. L. W. Vernon. Ind. Eng. Chem. *49*, 534-53 (Mar. 1957). Advances in colloid and surface research for the last two years are reviewed. The trend is away from data collection and towards fundamental investigations. 656 references.

Chemisorption and surface catalysis. M. J. Boudart and G. Parravano. Ind. Eng. Chem. *49*, 611-13 (Mar. 1957). Recent developments in chemisorption and surface catalysis are reviewed. 40 references.

Materials

Metallic soaps. M. D. Curwen. Plastics (London) *21*, 341-52 (Dec. 1956). The preparation and applications of metallic soaps are reviewed. Applications in the plastics industry include the use of zinc stearate for lubricating molds, the use of lead, calcium, chromium, and tin stearates, palmitates, laurates, and phthalates as polyvinyl chloride stabilizers, and the use of cobalt soaps in the cross-linking of polyester resins.

An osmometer with an ideal semipermeable boundary. D. T. F. Pals and A. J. Staverman. J. Polymer Sci. *23*, 69-73 (Jan. 1957). An osmometer was constructed in which the only possible transition from one cell to the other is through the vapor phase. In this way the problem of passage of solute is completely eliminated. To obtain sufficient rate of transition of solvent, the distance between the cells is made as small as possible. An osmometer with a vapor "membrane" of 0.05 mm. thickness is described and measurements with this osmometer are reported.

Studies on graft copolymers derived by ionizing radiation. W. K. W. Chen, R. B. Mesrobian, D. S. Ballantine, D. J. Metz, and A. Glines. J. Polymer Sci. *23*, 903-13 (Feb. 1957). Studies are presented on the preparation of graft copolymers by the gamma-ray irradiation of various polymer-monomer combinations. The following graft copolymers were prepared and evaluated for specific applications: (1) vinylcarbazole grafted to polyethylene to produce a higher temperature dielectric material; (2) styrene grafted to polyethylene and sulfonated to produce a cation exchange membrane of high mechanical strength, low resistivity, and high permeaselectivity; (3) surface grafting of styrene to polytetrafluoroethylene for modification of adhesive properties; and (4) acrylonitrile grafted to polydimethylsiloxane to increase solvent resistance of the latter.

Water-soluble ethylhydroxyethylcellulose. I. Jullander. Ind. Eng. Chem. *49*, 364-68 (Mar. 1957). Coetherification with ethylene oxide improves the water solubility of ethylcellulose considerably and the resultant cellulose ether, ethylhydroxyethylcellulose, has been produced commercially in Sweden since 1945. Method of manufacture and analytical problems are outlined briefly, but physicochemical properties are treated more fully. In many of its properties, such as solubility only in cold water, it resembles methylcellulose. Emphasis is placed on differences and properties for which few data have been available.

Nylon gets its second wind. Chem. Week *80*, 21-23 (Apr. 6, 1957). Nylon plastics are undergoing a rapid growth in production from about 2 million lb. in 1950 to an estimated 22 million lb. in 1957. There are now two producers and two others who are reported to be building plants.

Rigid p.v.c. development. L. H. P. Weldon. Plastics Inst. Trans. *24*, 303-25 (Oct. 1956). Processing and fabricating techniques and the properties of rigid polyvinyl chloride are reviewed. 98 references.

Molding and fabricating

Design hints for laminated plastics. G. A. Ebelijare. Product Eng. *28*, 186-87 (Jan. 1957). Satisfactory methods for designing parts of laminated plastics are illustrated.

Symposium on vacuum forming. Materials for vacuum forming. K. R. Greer. Plastics Inst. Trans. *25*, 69-74 (Jan. 1957). The properties of sheet plastics used in vacuum forming are reviewed and compared. These include acrylic, polyvinyl chloride, cellulose acetate, and styrene plastics. *Vacuum forming.* K. A. Ridley. Ibid. 75-76. The negative molding and drape or position molding techniques of vacuum forming are reviewed briefly. *Mold design and the molding of printed sheet.* L. Moncrieff. Ibid. 76-78. The design of molds and problems involved in vacuum forming printed sheet are reviewed briefly.

Applications

New uses for ion exchange resins. R. M. Wheaton. Chem. Eng. Progress *52*, 428-32 (Oct. 1956). Some interesting and important recent advances in uses for ion exchange resins are reviewed. Many of the newer uses do not involve ion exchange reactions in the strictest sense. Ion exclusion is a method for the fractionation of electrolytes from nonelectrolytes, both present in aqueous solution, by the use of ion ex-

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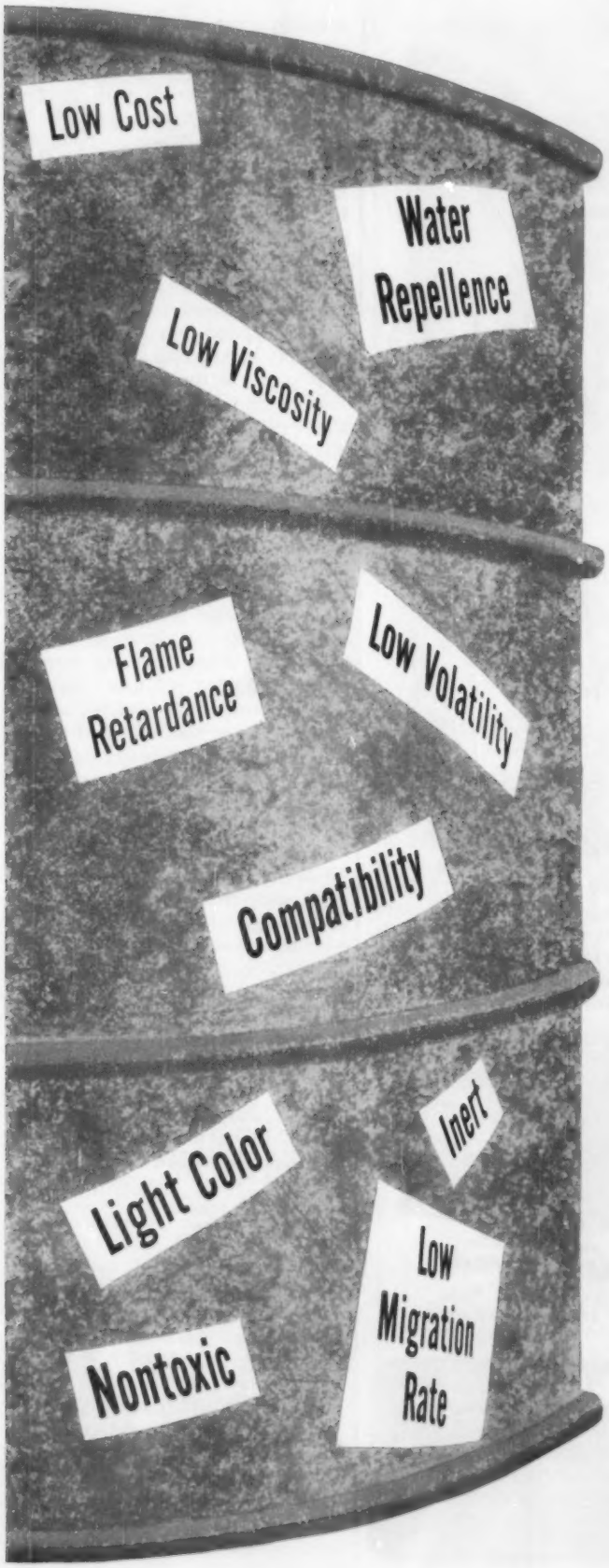
Radiotracer studies of p.v.a.-1. H. K. Inskip and J. H. Peterson. Modern Packaging *30*, 137-40 (Jan. 1957). Polyvinyl alcohol labeled with carbon-14 was exposed to typical edible fats and oils under conditions representative of those under which packaged foods might be kept. The oils were then recovered and analyzed. Those containing only a negligible amount of water did not extract significant amounts of the polymer from the films. At elevated temperatures, butter did dissolve a small amount of polyvinyl alcohol. On the basis of this data, the Federal Food and Drug Administration has stated that it has no adverse comment concerning the use of polyvinyl alcohol as a component of wrappers for fatty foodstuffs.

Properties

Mechanical properties of plastics dielectrics. B. Maxwell. Elec. Mfg. *58*, 146-53 (Sept. 1956). The results of extensive research in the mechanical properties of plastics dielectrics are summarized in terms of basic theory, experimental data, and design interpretation. In its service lifetime a dielectric material is subjected to various environmental and dynamic conditions. The proper design of dielectric and insulating parts must therefore take into consideration the full consequences of the mechanical as well as the electrical job to be done. To determine and apply the mechanical properties of plastics dielectrics, the traditional concepts of stress-strain relationships as they relate to metals must be modified in the light of the basic molecular behavior of polymers. New test methods must be devised. Effects of environmental conditions must be related to the time and temperature ranges of each application, and design data developed accordingly. Data are presented to show the effects of temperature and rate of straining on the stress-strain curve, load-elongation curve, tensile impact strength, and rebound hardness of various plastics materials. The effect of frequency and temperature on the dynamic properties of several plastics is also described. The basic theory underlying the effects of time and temperature on plastics is discussed.

Adhesion and friction. F. P. Bowden. Endeavor *16*, 5-18 (Jan. 1957). There is a close connection between friction and adhesion. Friction is essentially the shear strength, and adhesion the tensile strength of the junctions formed at the region of contact. For most solids, whether they are plastic, brittle, or elastic, the surface adhesion can be strong. The differences in the frictional behavior of various solids are due mainly to the difference in their mechanical properties, since it is this which determines both the area of real contact and the shear strength of the junction. Materials that give a high coefficient of friction will potentially give a strong adhesion. Whether this adhesion will in fact be observed depends primarily on the effect of elastic stresses released when the load is removed. If these stresses can be avoided, or if their effects can be accommodated by the ductility of the junctions, the potential adhesion will be observed. If they cannot be eliminated, the observed adhesion may be very small indeed. Lubricants that reduce the friction by diminishing the amount of metallic contact produce an even greater reduction in the adhesion. Similar considerations are important in the action of practical adhesives.

Measurement of cure rate of thermosetting molding materials. A. J. Guzzetti. A.S.T.M. Bulletin No. 220, 57-66 (Feb. 1957). The cure speeds of thermosetting materials may be estimated from the rigidity of hot molded pieces immediately upon discharge from the mold with results expressed as an apparent modulus of elasticity. Apparatus to make these measurements is described. The acceleration in cure, and hence increase in rigidity, resulting from increasing temperature in the range 305 to 365° F., is much greater for one-step phenolics than for two-step phenolics. Certain two-step, general-purpose phenolics are especially suited to low-temperature molding operations because they are faster curing and more rigid at low temperature than other general-purpose materials. Their rigidity does not increase as rapidly with increasing temperature and cure, as that of other two-steps. Rag-filled materials, especially at short cure times, are more rigid than otherwise similar materials containing finely-divided fillers. This is due to the reinforcing effect of the filler. Mineral-filled materials are somewhat more rigid than woodflour-filled materials of otherwise similar formulation. The effect at short cure and low temperature is attributed to greater thermal conductivity; but at longer cures, it must be due to filler reinforcement similar to that



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noted at room temperature. Silicones and rubber-modified phenolics are two classes of relatively slow-curing materials with very different characteristics. The silicones are slow-reacting (compared with phenolics) and therefore require a longer time to attain comparable rigidity at the same temperature. However, they become very rigid with longer cure and higher temperatures. The rubber-modified phenolics, on the other hand, are slow curing probably because the rubber content prevents the attainment of much rigidity. The result is that their rigidity rises very slowly with increased cure time and temperature.

Analytical studies on the aging of isocyanate-based foams. J. K. Buxbaum. Anal. Chem. *29*, 492-96 (Apr. 1957). Polyester urethane foams undergo changes during natural aging which stem from hydrolysis of the foam to form solvent-soluble polymer fragments, an insoluble residue, and carbon dioxide. The polymer fragments and the residue are similar in chemical structure to the original foam. The aging reaction is also associated with the formation of amine end groups. These can be detected by color tests in solid foam with bromophenol blue solution and in the extracts with p-chlorobenzenediazonium chloride solution. Samples of polyester foams that were artificially aged at 100% humidity and 70° or 90° C. showed the formation of the same general types of aging products as naturally aged samples. This suggests the possibility of establishing a reliable accelerated aging procedure and following the aging by extraction studies and color tests.

Testing

Determination of acetyl content of cellulose acetate by near infrared spectroscopy. J. A. Mitchell, C. D. Bockman, Jr., and A. V. Lee. Anal. Chem. *29*, 499-502 (Apr. 1957). The acetyl content of cellulose acetate can be determined by measuring, in the near infrared region of the spectrum, the absorbance due to the residual hydroxyl groups. Pyrrole is a suitable solvent, permitting the

determination of the acetyl content of cellulose acetates of from 35 to 44.8% acetyl. A statistical study of the accuracy and precision of the near infra-red, Eberstadt, and carbanilation methods of acetyl determination was conducted. The near infra-red method can be accurately calibrated; the precision is of the same order of magnitude as that of the Eberstadt method. The carbanilation method has limits of error about one half as great as the other two methods.

Chemistry

Synthesis of chemically uniform copolymers. Rapid calculation of monomer addition. R. J. Hanna. Ind. Eng. Chem. *49*, 208-09 (Feb. 1957). To produce a chemically uniform copolymer in a batch copolymerization catalyzed by free radicals, one of the monomers must usually be added during the reaction. For quick calculation of such monomer additions, equations have been derived. The method applies specifically to the batch production of a chemically uniform copolymer by maintenance of the original monomer-monomer ratio. The equations express the amount of monomer to be added with conversions, and estimate the rate of continuous monomer addition. Results compare favorably with monomer additions in the production of vinyl chloride-acetate resin VYCC.

Publishers' addresses

A. S. T. M. Bulletins: American Society for Testing Materials, 1916 Race St., Philadelphia, Pa.

Analytical Chemistry: American Chemical Society, 1155 Sixteenth St., N. W., Washington 6, D. C.

Chemical and Engineering News: American Chemical Society, 1155 Sixteenth St., N. W., Washington 6, D. C.

Chemical Engineering Progress: American Institute of Chemical Engineers, 120 E. 41st St., New York 17, N. Y.

Chemical Week: McGraw-Hill Publishing Co., 330 W. 42nd St., New York 18, N. Y.

Electrical Manufacturing: The Gage Publishing Co., 1250 Sixth Ave., New York, N. Y.

Endeavour: Imperial Chemical Industries, Nobel House, Buckingham Gate, London S. W. 1, England.

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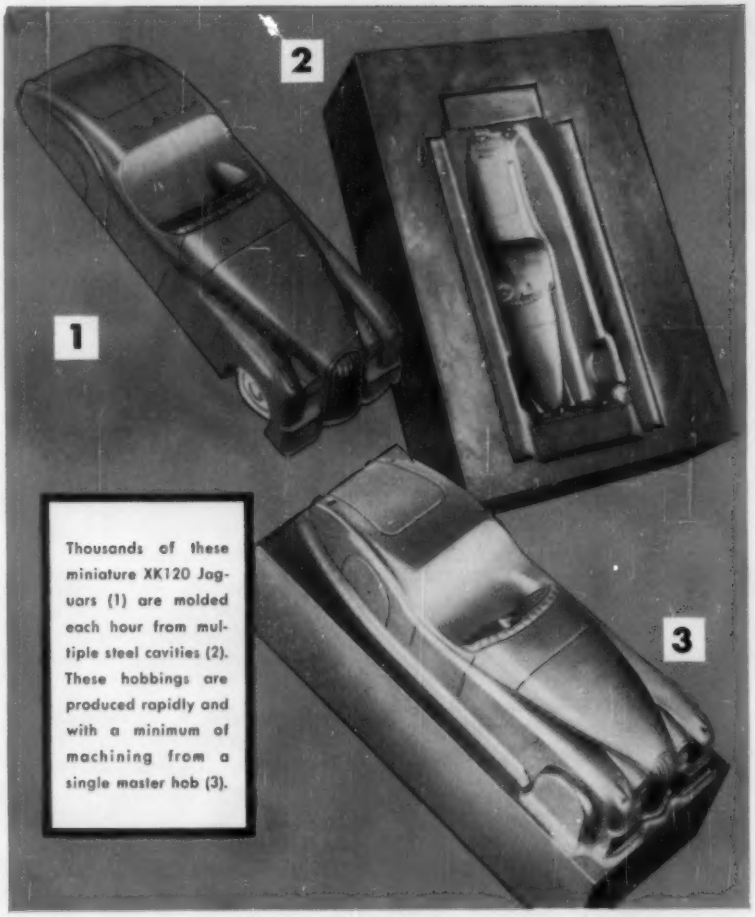
Journal of Polymer Science: Interscience Publishers, Inc., 250 Fifth Ave., New York 1, N. Y.

Modern Packaging: Modern Packaging Corp., 575 Madison Ave., New York 22, N. Y.

Plastics (London): Temple Press Ltd., Bowling Greene Lane, London, E. C. 1, England.

Plastics Institute Transactions: The Plastics Institute, 6 Mandeville Place, London W. 1, England.

Product Engineering: McGraw-Hill Publishing Co., 330 W. 42nd St., New York 18, N. Y.



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U.S. Plastics Patents

Copies of these patents are available from the U.S. Patent Office, Washington, D. C., at 25¢ each

Polyethers. M. Carmack (to Du Pont). U. S. 2,784,173, Mar. 5. Polymeric polyethers.

Condensates. H. D. Hartough and E. W. Murray, Jr. (to Socony). U. S. 2,784,174, Mar. 5. Condensates of thiophenes with formaldehyde and hydroxylamine salts.

Polymers. D. K. Keel and C. H. Mayhew (to I. T. & T.). U. S. 2,784,175, Mar. 5. Polymers of halogenated vinyl ethers.

Polymerization. A. L. Dittman and J. M. Wrightson (to M. W. Kellogg). U. S. 2,784,176, Mar. 5. Polymerization of perhalocarbons.

Polyvinyl chloride. K. H. C. Bessant, A. G. Goodchild, et al. (to Distillers). U. S. 2,784,177, Mar. 5. Paste-forming polyvinyl chloride.

Film. T. A. Grabenstein (to Du Pont). U. S. 2,784,456, Mar. 12. Heat-shrinkable polyethylene-terephthalate film.

Polyethylene terephthalate. K. L. Sayre (to Bjorksten Research). U. S. 2,785,085, Mar. 12. Treating polyethylene terephthalate with a vinyl silane.

Coating. W. Kirk, Jr. (to Du Pont). U. S. 2,785,090, Mar. 12. Fabric coated with poly p-xylene.

Reinforced rubber. P. G. Edgerly (to Imperial Chemical). U. S. 2,785,143, Mar. 12. Rubber reinforced with a methyl methacrylate copolymer.

Aminoplast. T. F. Cooke, L. A. Fluck, and P. B. Roth (to American Cyanamid). U. S. 2,785,145, Mar. 12. Siliconate-aminoplasts.

Resins. J. C. Hillyer and J. T. Edmonds (to Phillips Petroleum). U. S. 2,785,148, Mar. 12. 2,3,4,5-bis(delta-butenylene)-tetrahydro-furfural resins.

Polyesters. L. C. Kreider and R. F. Nichols (to Goodrich). U. S. 2,785,150, Mar. 12. Elastomeric polyesters.

Heat sealing. R. A. Smith and F. W. West (to M. W. Kellogg). U. S. 2,785,729, Mar. 19. Device for heat-sealing plastics.

Cushions. W. A. McGregor, Jr. and J. D. Mahoney (to Mobay). U. S. 2,785,739, Mar. 19. Polyurethane cushions.

Molded joint. C. G. Munger (to Amercoat). U. S. 2,785,910, Mar. 19. Molded joint for plastic tubes.

Fiber. N. J. Sheeran (to American Marietta). U. S. 2,785,975, Mar. 19. Cellulose fiber product containing latex solids and a cured phenolic resin.

Coated surface. W. D. Paist and F. J. Rielly (to Celanese). U. S. 2,785,993, Mar. 19. Aluminum surface with resinous coatings.

Polymers. J. Dazzi (to Monsanto). U. S. 2,786,039-41, Mar. 19. Plasticized polyvinyl chloride.

Polyacrylonitrile. W. H. Schuller and E. J. Kerle (to American Cyanamid). U. S. 2,786,043, Mar. 19. Plasticized polyacrylonitrile.

Film. W. C. Warner and E. E. Gruber (to General Tire and Rubber). U. S. 2,786,044, Mar. 19. Hydrazone-stabilized polyvinyl chloride film.

Polymers. J. S. Chirtel, A. M. Mark, and S. Brelant (to Tee-Pak). U. S. 2,786,045, Mar. 19. Polymers of hydroxyacyl amine acids.

Copolymers. F. D. Stewart (to B. F. Goodrich). U. S. 2,786,046, Mar. 19. Copolymers of vinylidene cyanide with acenaphthylene.

Molding. C. E. Beyer (to Dow) U. S. 2,786,234, Mar. 26. Automated injection molding.

Containers. W. H. Shapero (to Wallace Containers). U. S. 2,786,238, Mar. 26. Dip-molding plastic containers.

Joining. A. A. Reid (to General Mills). U. S. 2,786,511, Mar. 26. Apparatus for forming thermoplastic seams.

Films. P. V. Palmquist (to Minnesota Mining). U. S. 2,786,778, Mar. 26. Ink-receptive resinous films.

Coating. W. E. Walles and H. G. Hahn (to Dow). U. S. 2,786,780-3, Mar. 26. Coating process for polyethylene.

Laminate. J. J. Klein and E. N. Maisel (to Fibre Bond). U. S. 2,786,790, Mar. 26. Laminated fabric.

Flexible articles. W. F. Mikiska (to Minnesota Mining). U. S. 2,786,792, Mar. 26. Polytetrafluoroethylene articles.

Resin. A. Gams, W. Kraus, E. Preiswerk, G. Widmer, and W. Wieland (to Ciba). U. S. 2,786,794, Mar. 26. Adhesive of a polyglycidyl ether of a polyhydric phenol.

Plastics. V. C. Vesce (to B. F. Goodrich). U. S. 2,786,822, Mar. 26. Pigmented vinylidene plastics.

Resins. G. I. Keim (to Hercules). U. S. 2,786,823-6, Mar. 26. Cationic urea resins.

Polymers. W. S. Barnhart (to M. W. Kellogg). U. S. 2,786,827, Mar. 26. Phosphorus oxychloride-halogen-containing telomers.

Polymer. W. O. Teeters, R. M. Mantell and H. J. Passino (to M. W. Kellogg). U. S. 2,786,874, Mar. 26. Fluorine-containing polymers.

Reinforced plastic. D. F. Anderson (to Canadian Ingersoll-Rand). U. S. 2,787,314, Apr. 2. Reinforced plastic article.

Emulsions. J. W. Gates, Jr., J. R. Dann, B. D. Illingsworth, and W. G. Lovett (to Eastman Kodak). U. S. 2,787,545, Apr. 2. Photographic emulsions containing gelatin-acrylic acid graft polymers.

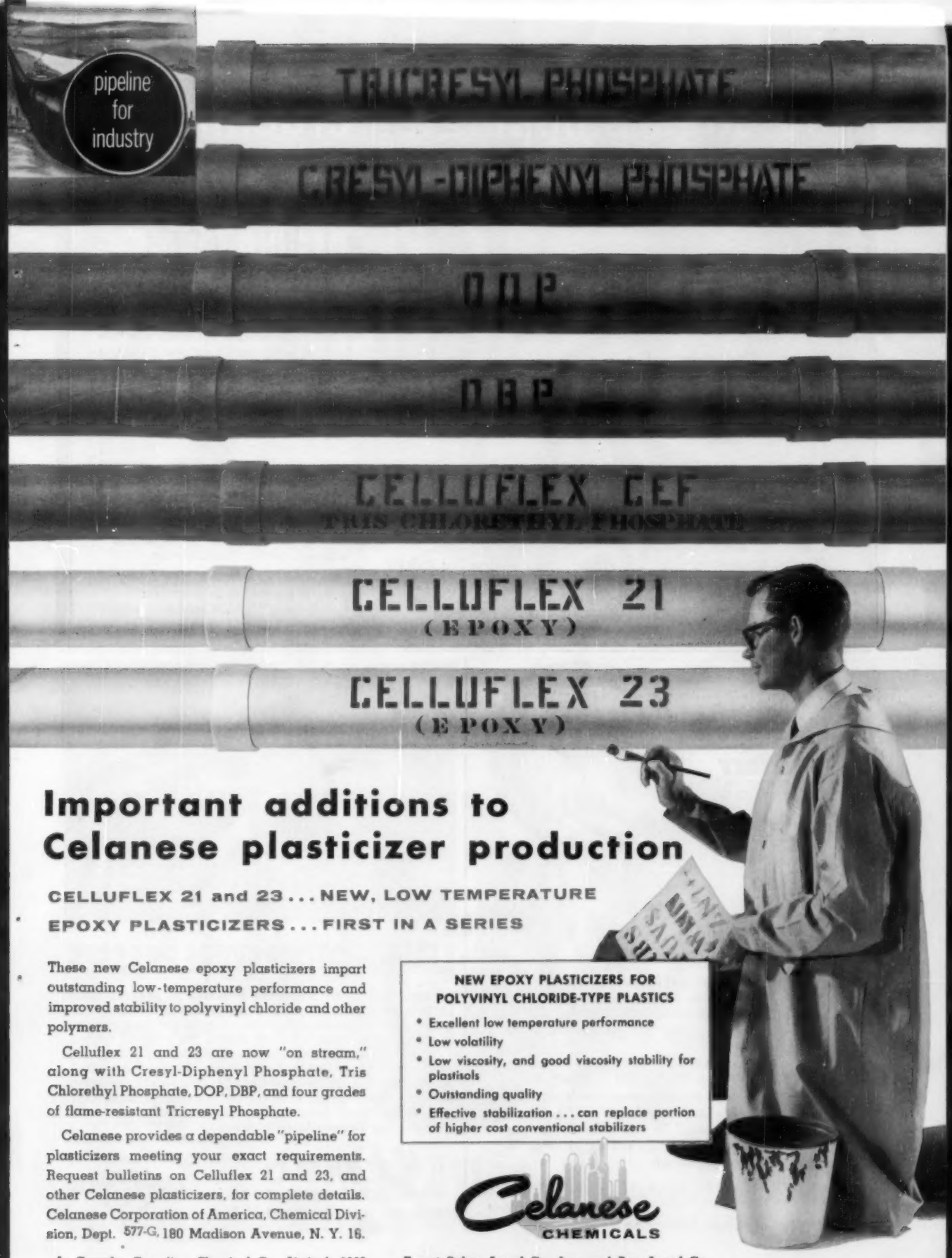
Photographic elements. A. C. Smith, Jr., D. A. Smith, and C. C. Unruh (to Eastman Kodak). U. S. 2,787,546, Apr. 2. Polyvinyl acetal compositions.

Interpolymers. P. F. Sanders (to Du Pont). U. S. 2,787,561, Apr. 2. Cross-linkable acrylonitrile interpolymers.

Adhesive. F. F. Koblitz (to Bjorksten Research). U. S. 2,787,568, Apr. 2. Alkenyl diglycol carbonate adhesive.

Reinforced sheet. de F. Lott and E. G. Hamway (to General Tire & Rubber). U. S. 2,787,570, Apr. 2. Sheet reinforced with nylon fibers interwoven with glass fibers.

Mat. R. E. Schwartz (to Malloran).



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LEMBO PRESS

U. S. 2,787,572, Apr. 2. Fiber-reinforced elastomer mat.

Cellular plastics. S. R. Detrick and E. Barthel, Jr. (to Du Pont). U. S. 2,787,601, Apr. 2. Cellular condensates of hydroxy glycerides and diisocyanates.

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Polymers. J. R. Miller (to B. F. Goodrich). U. S. 2,787,604, Apr. 2. Aqueous polymerization using water-soluble N-dodecyl-beta-alanine.

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Polymerization. H. J. H. Janssen (to Naamlooze Vennotschap Kunstzijdespinnerij Nyma). U. S. 2,787,610, Apr. 2. Polymerizing acrylonitrile.

Shaped articles. F. Stastny (to Badische Anilin). U. S. 2,787,809, Apr. 9. Porous shaped thermoplastic articles.

Coating. O. S. Tuttle (to Honeycomb Structures). U. S. 2,788,051, Apr. 9. Apparatus for applying a coating to a sheet.

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Polyamides. S. Zweig (to Borden). U. S. 2,788,287, Apr. 9. Non-gelling polyamides.

Coating. A. S. Louis (to M. A. Coler). U. S. 2,788,296-7, Apr. 9. Electrically conductive coating.

Laminates. R. P. Cox, L. L. Yaeger, and R. W. Buetow (to Pittsburgh Plate Glass). U. S. 2,788,306, Apr. 9. Surface treatment of halogenated fluoroethylenes.

Ion exchange. M. E. Gilwood and A. H. Greer (to Permutit). U. S. 2,788,330-1, Apr. 9. Anion exchange resins.

Foamed resins. E. Muller and P. Hoppe (to Bayer). U. S. 2,788,332, Apr. 9. Foamed diisocyanate resins.

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New Machinery and Equipment*

12/16-oz. injection machine

The model 300TL injection molding machine resembles the 300TA in many respects (see this department, October, 1955, p. 184), but has a much longer stroke and slightly slower dry-cycling speed. It is a horizontal machine with a rated shot capacity of 12 oz. of polystyrene, with up to 16 oz. with prepacking. Mold clamping stroke ranges from 8.5 to 20.2 in., mold thickness from 8 to 22 inches. Dry cycle time is 12 seconds. The Model TL is longer than the TA, but has the same width and height, making its dimensions (L, W, H) 24 by 5 by 7 feet. Other specs are the same as for Model 300 TA. *Reed-Prentice Corp., Worcester 4, Mass.*

Automatic die cutter

A roller-type die cutter will cut parts from continuous roll stock up to 72 in. in width. The roll stock is fed between power-driven pinch rolls that pull a predetermined length of stock from the supply roll. The loose stock trips a switch that moves the cutter roll to the rear of the machine while two other pinch rolls pull the stock onto the cutter bed over the dies. The cutting roll then traverses the bed, making the cuts. The pinch rolls are powered by a Dyna-Brake motor, controlled by a Campbell lineal footage timer. The cutting roll is actuated by 80-p.s.i. air. Bed size is 72 by 66 in., and an 84 by 72-in. machine will soon be available. *Falls Engineering & Machine Co., 1734 Front St., Cuyahoga Falls, Ohio.*

Expansion inserts

Dodge inserts are designed to be installed in finished moldings, rather than molded in. The cylindrical body of the threaded section of each insert is extended to four knurled fingers that have been squeezed together. In this phase the insert drops easily into a molded (untapped) hole, fingers first. A spreader plate in the insert is then forced downwards, spreading open the fingers as it goes, and firmly embedding the knurled surfaces into the plastic. Numerous advantages are claimed: reduced molding cycles; simplified mold construction, operation, and maintenance; elimination of tapping of plastic hole; etc. Available in five sizes: 4-40, 5-40, 6-32, 8-32, and 10-32. *The Phelps Mfg. Co., Colonial Green Bldg., Westport, Conn.*

Polyethylene-based mold release

Poly-Lease 77 consists of a low-molecular-weight polyethylene in a mixed solvent, supplied as an aerosol. When sprayed onto a mold surface it soon forms a smooth, relatively hard coating. It is said to work especially well with molds used in casting epoxy, phenolic, and polyester resins. It may be used on porous casting molds, such as those made of plaster or wood, if they are first sealed with shellac or lacquer. It leaves no residual film on the molded item, and therefore does not interfere with subsequent finishing operations. *Barrett Div., Allied Chemical and Dye Corp., 40 Rector St., New York 6, N. Y.*

Vinyl curtain maker

Combining several pieces of equipment, a new process for fabricating plastic curtains is capable of turning out 1800 to 2000 units per day. A rotary sealer, drawing sheet from continuous rolls in widths up to 72 in., first side-hems the material, after which it is re-rolled. An 80-in. "thruway" press then attaches a clear, heavy-gage vinyl header, forms 12 grommets with tear centers, and bottom-hems the curtain. Tear centers are automatically ejected. Either a straight or scallopped top may be formed, and the apparatus serves equally well in making either shower curtains or cafe window curtains. *Mayflower Electronic Devices, Inc., Little Ferry, N. J.*

Small injection presses

The models 357 and 357A resemble in general construction features and specifications their predecessors, the 356 and 356A, which were described in this department, June, 1956, p. 289. However, they have been furnished with an auxiliary 5-g.p.m. pump that cuts their dry-cycle time to just over half that of the earlier models. The two machines are rated for 2.75 oz. of polystyrene

*Specifications and claims made and appearing in these pages are those of the manufacturers of the machinery and equipment described and are not guaranteed by Modern Plastics



Falls Engineering and Machine roller-type die cutter has a bed size of 72 by 60 in.; operates continuously

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MODEL H-250 PRESS 2½ OZ.

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Up to 1200 cycles per hour (dry run)

AUTOMATIC!

One operator can run 3 or more presses, for greater flexibility, and lower labor costs. Selective control permits semi-automatic operation.

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by semi-skilled help. With simple, handy controls, job can be set up in 20 minutes.

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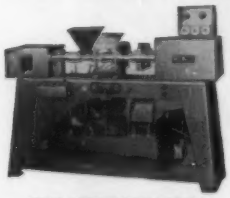


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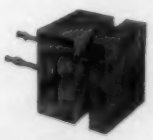
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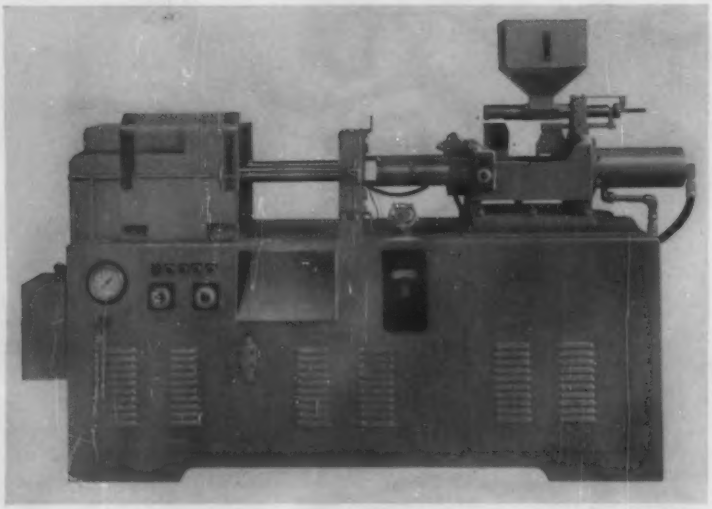


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MOLD BASES Available from stock.

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Clifton Hydraulic Press small injection machine is equipped with a 5-gal./min. auxiliary pump for fast cycling

per shot at pressures of 20,000 and 10,000 p.s.i. with dry-cycle times of 3.3 and 4.6 sec. respectively. They are both equipped with a new, accurate volumetric feeder and they feature a movable rear die plate that makes it easy to change or clean the cylinder nozzle. Top mold size is 12 by 12 in. by 4 in. thick, top clamping force is 65 tons. *Clifton Hydraulic Press Co., 289 Allwood Rd., Clifton, N. J.*

Thermal conductivity probe

The Pittsburgh Corning Thermoconductivity Probe is a simple device that operates by taking advantage of the fact that the temperature in the vicinity of a line heat source in a block of insulating material rises by an amount that depends on the thermal conductivity of the material. The probe is essentially a line heat source with a thermocouple that measures the change in temperature at the mid length of the source The probe is 8 in. long by 0.020 in. in diameter, can operate over the range from —50° to +200° F. Results are said to be reproducible to 1%. An advantage of the method is that, unlike the Guarded Hot Plate method, it permits estimation of the effect of moisture on the thermal conductivity of the material. Not counting the time required to bring the sample uniformly to the temperature of the test, the results are obtained in 15 minutes. *Custom Scientific Instruments, Inc., Kearny, N. J.*

Multi-component foamer

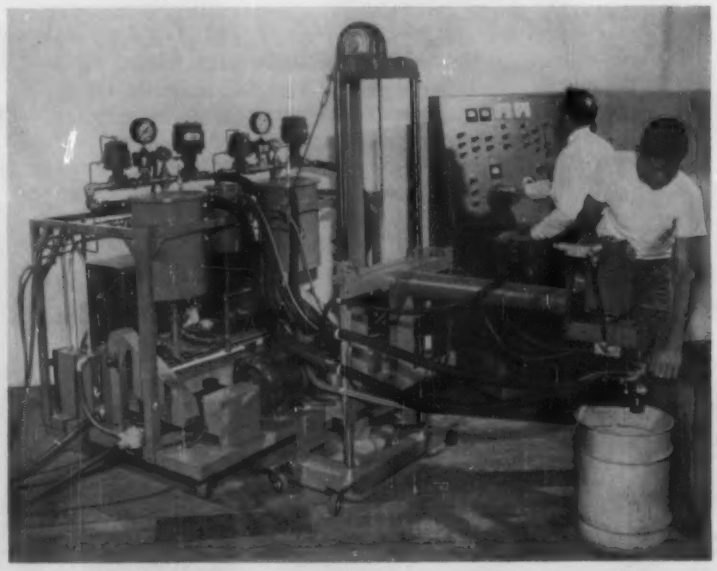
A new blending machine will thoroughly blend two- and three-component foaming chemical-and-resin systems. Resins having viscosities up to 700 poises can be handled. The foamer is adapted to spray the just-mixed foam if that is desired. The mixing head is of the Du Pont type, can be operated at speeds from 0 to 5000 r.p.m. Shot size is controlled by a timer accurate to 0.01 sec. in intervals from 0.3 to 120 seconds. Clean-out is accomplished by dismantling the mixing head, an operation that is very quick, and dropping the parts into a solvent solution. Short shut-downs can be made without cleaning. *The Martin Sweets Co., 114 S. First St., Louisville 2, Ky.*

Plastic granulator

The M-75 granulator is the newest member of the Marvel series and incorporates the design features of its mates. The heavy-duty knives will grind all thermoplastics, including elastomers, at rates up to 75 lb./hr. The 8- by 6-in. feed throat opening will accommodate moderate-sized scrap pieces as well as sprues and runners. Quick-opening clamps expose the entire interior for cleaning. A sight-glass on the bin side shows product level. The M-75 is powered by a ¾-hp. motor, takes up 20 by 22 in. of floor space, and is mounted on casters. *Ball & Jewell, Inc., 22 Franklin St., Brooklyn 22, N. Y.*

Screw extruders

The Rolis line of extruders, ranging in size from 1.5 to 4.5 in. in diameter, are said to be designed for durability. The barrel of each



The Martin Sweets blending machine accommodates two- and three-component foaming chemical-and-resin systems

U.S.I.
Vol. II, No. 4

POLYETHYLENE PROCESSING TIPS

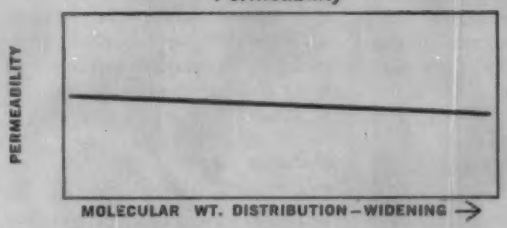
HOW MOLECULAR WEIGHT DISTRIBUTION AFFECTS POLYETHYLENE PROPERTIES

MOLECULAR WEIGHT DISTRIBUTION is one of three basic characteristics that determine the properties of articles made of polyethylene. MOLECULAR WEIGHT and DENSITY are two others.

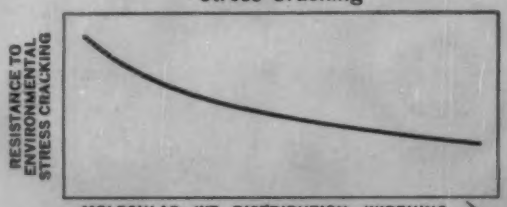
Any polyethylene resin contains molecules of many different sizes. Molecular weight distribution is a measure of how widely these sizes vary from the average.

The following graphs show the effects of widening MWD, assuming density and molecular weight remain unchanged. In aiming for specific end properties, of course, all three characteristics must be taken into account, as all can be varied.

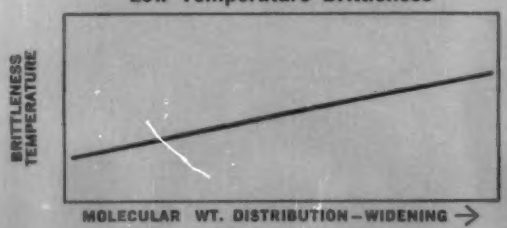
Permeability



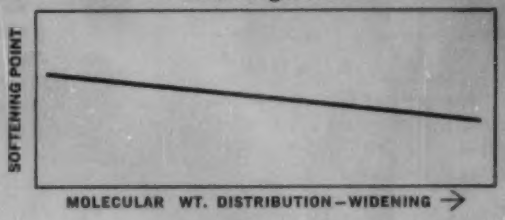
Resistance to Environmental Stress Cracking



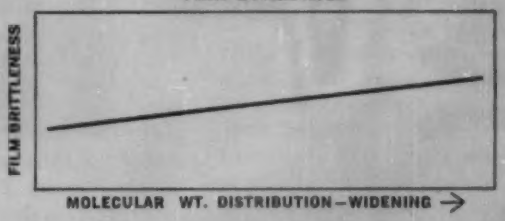
Low Temperature Brittleness



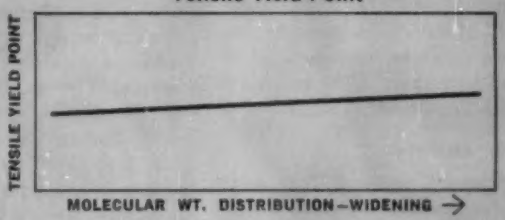
Softening Point



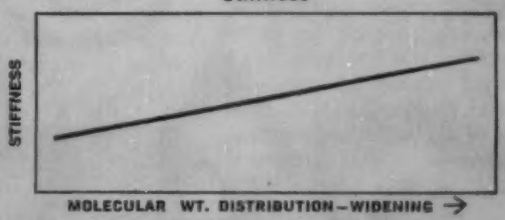
Film Brittleness



Tensile Yield Point



Stiffness



U.S.I. "Tips" covering the effects of density, molecular weight and molecular weight distribution have now appeared, and make a handy reference guide. To receive copies, just ask for back issues of "Polyethylene Processing Tips."

If you're planning a new or improved polyethylene product remember that U.S.I. PETROTHENE® resins have been tailored to give you the properties you want.

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Division of National Distillers and Chemical Corporation
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Specifications for Rolis extruders

Diameter, in.	Motor, hp.	Heaters, total kw.
1.5	3	7
2	7.5	10.5
2.5	15	15.5
3.25	25	22.5
4.5	75	27.5

is a one-piece, heavy-walled, jacketed steel cylinder fitted with a removable Xaloy 306 liner. The barrel is electrically heated and water cooled, for fast response, but oil-heated cylinders are available. The chrome-plated screw has an L/D ratio of 20:1 on the standard-length machine in each size class. Instrumentation includes a speed indicator, speed changer, pre-wired temperature control cabinet. Normal speed range in all sizes is 10 to 70 r.p.m., but higher speeds may be had on order. Motor and heater ratings are listed herewith. Motor horsepowers are common values, can be less or more, as desired. *Rolis Inc., 1240 E. 14th St., Brooklyn 30, N.Y.*

Water chillers

A packaged water chiller, suitable for cooling injection molds, is available in 3- and 5-hp. sizes. The unit consists of the chiller proper, compressor, water-cooled condenser, and controls. It is protected against the possibility of water freezing inside it. Floor space of 8.3 sq. ft. is required. *Worthington Corp., Harrison, N. J.*

Physical testing machine

An air-operated testing machine is suitable for all types of stress-rupture and creep tests. Loads up to 6 or 10 tons can be applied by either of two models, and can be maintained over periods ranging from minutes to years. An optional feature is a built-in elongation or *xy* recorder. Also optional is a built-in furnace with controls that make it possible to test materials at temperatures up to 2000° F. The machine has few moving parts; its lever-less action simplifies operation and reduces maintenance. It meets ASTM and Federal accuracy requirements. *Tinius Olsen Testing Machine Co., Easton Rd., Willow Grove, Pa.*

Automatic marking machines

Two English-made, automatic marking machines have been added to an existing line. The Rejafix model 555 will print in one of two colors onto cylindrical items of diameters between ⅜ and 1 inch, and up to 6 in. in length. Up to 9000 pieces per hour may be printed.

The semi-automatic "Four-Square" model prints on products of many shapes in one or more colors. Printing area is about 5 by 3 in., and rates up to 1500 pieces per hour may be realized. Sold and serviced in the U.S. by *Popper & Sons, Inc., 300 Fourth Ave., New York, N. Y.*

Extrusion molding machine

The Foster-Wucher W700 consists of an extruder and a turntable containing multiple molds. The extruder drive is connected to the screw, through a magnetic clutch, which is engaged only when a mold is indexed to the nozzle. The extruder then fills the mold and is stopped, the turntable indexes the next mold, and the last-filled mold cools as it proceeds around the circuit. Since injection pressure is relatively low, molds can be made of cast aluminum or zinc alloy. Sandals, high heels, and shoe soles have been commercially molded in France on this machine. Screw diameter is 4 in., length is 30 in., speed ranges from 140 to 280 r.p.m., drive horsepower is 13—most of the plasticating is done by viscous working. Shot capacity is about 50 oz., injection time about 4 to 15 seconds.

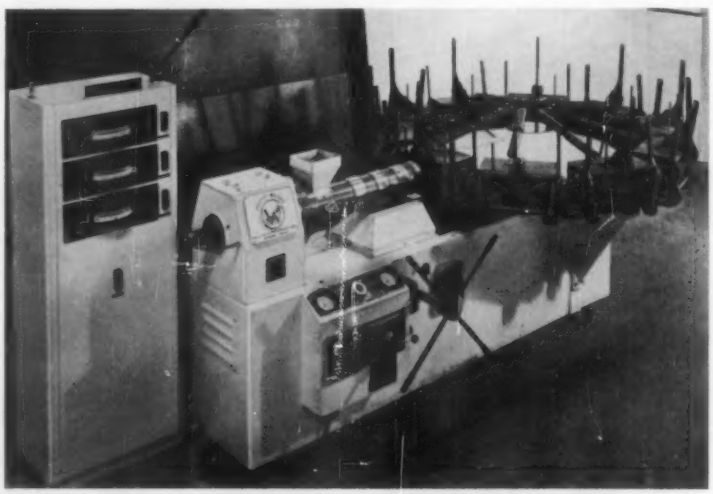
Since the indexing time is very small and the operator can unload one mold while another is filling, the injection time is very nearly the whole cycle—very short for a 3-lb. shot. At present, two operators are required to run the machine at full capacity. Sold and serviced in the U.S. by *International Vulcanizing Corp., 104 Brookline Ave., Boston 15, Mass.*

Diisocyanate vapor detector

A field kit detects concentrations of diisocyanate and diisocyanate urea vapors as low as 0.05 p.p.m. (Present industrial hygiene practices prescribe a level of less than 0.1 p.p.m. for eight-hour exposure.) The kit consists of a case containing the apparatus, a hand-cranked pump, an interval timer for controlling sample volume, and polyethylene-bottled reagents. The method is colorimetric. *Mine Safety Appliances Co., 201 N. Braddock Ave., Pittsburgh, Pa.*

Molding press

The Models 150-22 and and -33, with 75 tons capacity, are especially engineered for precise control of temperature and pressure. Platens are 14 by 14 in., the



Foster-Wucher extrusion molding machine. Timed vibratory feeder, normally mounted above drive, has been removed

modern ... with injection molding

EFFICIENT & ECONOMICAL

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PLASTIC INJECTION MOLDING MACHINES

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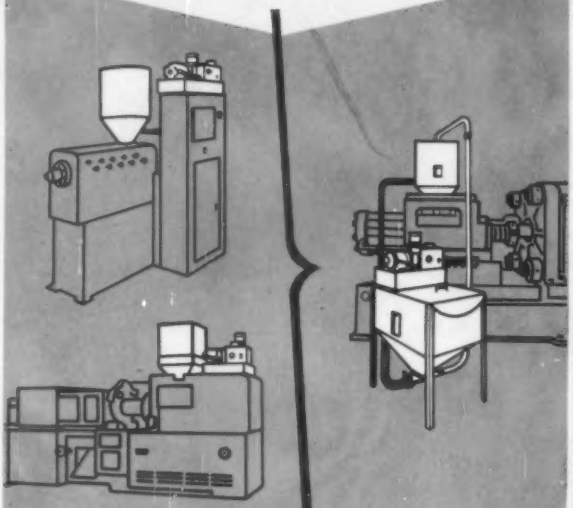
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- Special tolerance control insures *exact* dimensions ordered.
- In addition to our stock size, we can extrude to any size you require.

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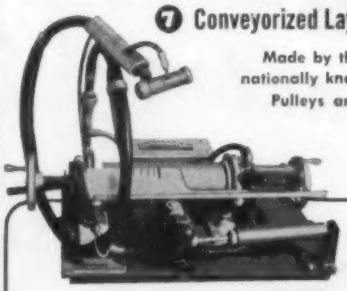
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1. Dispensing Equipment
2. Conveyorized Ovens
3. Cooling Systems
4. Stripping Tables
5. Vacuum Stripping Units
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Model AD
Automatic

Precise metering—dispensing units allowing infinite adjustment from 12 to 1000 grams—Drip proof nozzle —No waste!

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HILLSDALE, NEW JERSEY
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Model 22 having two, the 33 having three. Total daylight opening is 6 in., stroke is 6 in., ram diameter is 6.5 in. Closing speed is 50 in./min., and the ram returns



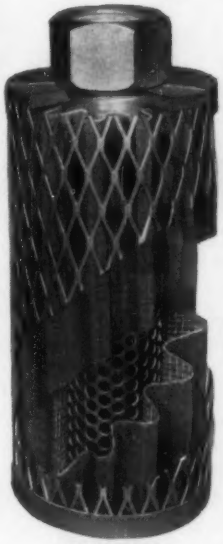
Atlas Hydraulic molding press of the Model 150 series has 75-ton capacity

(falls) under its own weight when pressure is released. Available temperature range is 150 to 550° F. with built-in electrical heating. The hydraulic system is powered from any available 100-p.s.i. shop air line. Higher tonnages, longer strokes and daylights, higher temperatures, and water cooling are available if desired. *Atlas Hydraulics, Inc., 3576 Ruth St., Philadelphia 34, Pa.*

Resin and hardener dispenser

The Ki-Pla-Blender is actually a hand- or motor-operated dispenser that accurately meters amounts of epoxy (or other) resin from 10 g. to 3 lb. per shot. with the proper amount of hardener. The two materials, accurately proportioned by gear-driven positive-displacement pumps, are delivered together by adjacent nozzles. Any mixing or blending must be accomplished outside the dispenser. A mixing attachment is optionally available. The dispenser is compact and portable, weighing only 30 pounds. *Kish Industries, Inc., 1301 N. Turner St., Lansing, Mich.*

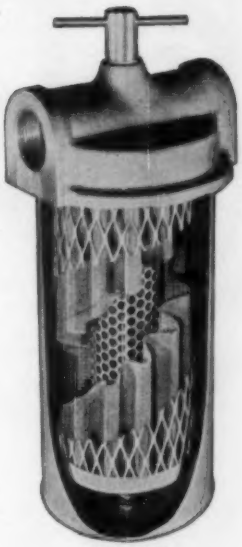
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Meet J.I.C. Standards

OVER 750 Original Equipment Manufacturers now install MARVEL SYNCLINAL FILTERS as Standard Equipment



SUMP TYPE (cutaway)

LINE TYPE (cutaway)

Hydraulic Oils MUST BE CLEAN to Protect Equipment — Increase Production — Reduce Maintenance

PRODUCTION ENGINEERS and MAINTENANCE MEN, whose job it is to keep production machinery operating at peak efficiency, are specifying Marvel Synclinal Filters on new equipment and standardizing with Marvels throughout their plants.

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The Synclinal design of Marvel Filters provides that all-important balance between maximum ACTIVE filtering area and sufficient storage capacity for filtered out particles. Thus, longer periods of productive operation are attained before filter cleaning is necessary. Marvel Synclinal Filters are easy to clean because both the sump and line type may be disassembled, thoroughly cleaned and reassembled in a matter of minutes. Line type operates in any position and may be serviced without disturbing pipe connections.

A SIZE FOR EVERY NEED

Available for sump or line installation in capacities from 5 to 100 G.P.M. Greater capacities may be attained by multiple installation (as described in catalog). Choice of monel mesh sizes range from coarse 30 to fine 200.

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As in the past, Marvel continues to offer IMMEDIATE DELIVERY.

FILTERS FOR FIRE-RESISTANT HYDRAULIC FLUIDS

Marvel's most recent development is a filter for the efficient filtration of all types of Fire-resistant hydraulic fluids.

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Both sump and line type filters have been adapted for use in all water filtering applications. No changes have been made in the basic, balanced synclinal design.



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- ☐ Catalog #200—For Fire-resistant Hydraulic Fluids (Aqueous Base)
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Books & Booklets

Write for these publications to the companies listed. Unless otherwise specified, they will be sent gratis to executives who request them on business stationery.

"Enciclopedia Annuario delle Materie Plastiche"

Published in 1957 by Edifrice L'Industria, Via Farneti 8, Milano, Italy. 1042 pages. Price (including packaging and mailing): L. 1.900 (ca. $3.25).

First Italian publication of its kind, this encyclopedia was prepared by the editorial staff of *Materie Plastiche* with the collaboration of more than 80 plastics experts, contains 36 chapters on resins and products for the plastics industry such as fillers, colors, plasticizers, stabilizers, solvents, etc., (including a chapter on the new polypropylene); eight chapters on machinery and equipment; 13 chapters on processing methods; and 18 chapters on fields of application and uses of plastics.

Bound in vinyl sheet and well illustrated, this yearbook is also a classified guide to suppliers of materials and manufacturers of plastics products and equipment. It contains 6000 trade names together with addresses of the respective manufacturers.

"Scientific French"

By William N. Locke
112 pages. Price: $2.25

"Scientific German"

By George E. Condoyannis
164 pages. Price $2.50.

Published in 1957 by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, New York.

Both books are designed to fill the need of the scientist or engineer, as well as the student preparing for these professions, to acquire rapidly and directly a reading knowledge adequate to cope with the technical articles and books in his field published in French or German.

The authors (Prof. Locke is head of the Dept. of Modern Languages, Massachusetts Institute of Technology; Prof. Condoyannis teaches at St. Peter's College) feel that their books should be used from the very beginning in conjunction with readings from simplified scientific and technical material and with a dictionary.

While directed primarily to beginners with no previous knowledge of the languages, the books should be useful to those who wish to take a refresher course. They can also be used in classes or for individual study.

Profits and losses. A 2¼- by 7¼-in. "slide-rule" called Profit-O-Meter shows the pitfalls of price-cutting at a glance. It lists 15 different profit margins from 10 to 50% and 10 different price cuts from five to 30% with added sales needed to offset them. Price: $1.00. *The Eddy-Rucker-Nickels Co., 4 Brattle St., Cambridge, Mass.*

New markets. New ways for large and small businesses to turn their "know-how" into profits overseas. 6 page folder. *Pegasus International Corp., 1 E. 53rd St., New York 22, N. Y.*

Epoxy on concrete. "Permanent Repair and Restoration of Cracked and Spalled Concrete and Other Masonry Structures" gives detailed instructions for performing such work with Permagile epoxy-based industrial plastic alloys. 4 pages. *Permagile Corp. of America, 37-23 33rd St., Long Island City 1, N. Y.*

Protective linings and coatings. Types of protective linings and coatings and how they should be applied. Discussed also are porosity; organic, inorganic, metallic, and combination coatings; and sheet linings. Sample specification sheets are shown. 35 pages. *Protective Coatings Div., Metalweld, Inc., Scotts Lane & Abbottsford Ave., Philadelphia 29, Pa.*

Molding. In "The Economical Use of Cooling Water" a thorough analysis is given of the cost of the heat lost in the water used to cool injection molds and compression molding platens and presses. 39 pages. *British Industrial Plastics Ltd., 1 Argyll St., London, W.1, England.*

Automatic machinery. Brochure describes and gives price data for Kval automatic woodworking machinery for plastic sheets, doors, plywood panels, etc. *Kvalheim Machinery Co., P.O. Box 77, 823-825 Third St., Petaluma, Calif.*

Product and warehouse catalog. Plastic mold and die casting steels and 15 other categories of special steels are described in a new catalog which covers over 700 products. 232 pages. *Engineering Service Dept., Crucible Steel Co. of America, Box 1558, Pittsburgh 30, Pa.*

Boxes and jars. Price list gives ordering data for line of crystal polystyrene and crystal acetate squat jars, and Lustrex styrene boxes. *Bradley Industries, 1650-58 N. Damen Ave., Chicago 47, Ill.*

Polyethylene. "The ABC's of Marlex 50 Polyethylene" describes this first commercial product of Phillips' polyolefin process, gives its advantages, and lists typical applications. 26 pages. *Plastics Sales Div., Phillips Chemical Co., Bartlesville, Okla.*

Teflon terminals. Specification bulletins are now available on Trinseel, a line of Teflon-insulated sub-miniature stand-off and feed-through terminals which have "flash-over" points better than 500 v. A.C. *Electronics Div., Tri-Point Plastics, Inc., 175-177 I.U. Willets Rd., Albertson, L.I., N.Y.*

Adjustable autotransformers. Bulletin O describes the complete line of Variac adjustable autotransformers. Dimension drawings, in addition to photographs,

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Flow Range	Soft to Hard
Granulation	16 Mesh
Bulk Factor	2.4-2.7
Mold Shrinkage	0.005-0.007 in./in.
Molded Specific Gravity	1.38-1.39
Heat Distortion Temperature °F.	290 min.
Water Absorption	0.5% max.
Tensile Strength	6,500 psi min.
Flexural Strength	9,000 psi min.
Compressive Strength	30,000 psi min.
Impact Strength, Izod.	0.30 ft. lbs./in. of notch, min.
Dielectric Strength, Short Time	300 volts/mil, min.
Dielectric Strength, Step by Step	200 volts/mil, min.
Dielectric Constant @ 1,000 cycles	7.0 max.
Power Factor @ 1,000 cycles	0.07 max.

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are included for all models, and complete specifications and prices are given. 24 pages. *General Radio Co., 275 Massachusetts Ave., Cambridge 39, Mass.*

Epoxies. "New Horizons for Epon Resins" describes and illustrates a number of new applications for these epoxy copolymers as used by the airlines, automotive, home appliance, and other industries. 18 pages. *Shell Chemical Corp., 380 Madison Ave., New York, N. Y.*

Phenolic compound. Complete physical properties of Durez 16274 Natural, a two-step, mineral-filled phenolic with excellent electrical properties. *Durez Plastics Div., Hooker Electrochemical Co., Walck Rd., N. Tonawanda, N. Y.*

Vacuum former. Features and specifications for Rotary-Vac, a three-stage vacuum forming machine. *Comet Industries, 10406 S. Western Ave., Chicago 43, Ill.*

Temporary destaticizers. Electrosol surface coatings which are stable to light, do not create stress cracking of plastic sheets, and give temporary anti-static properties. 4 pages. *Alframine Corp., 72-76 Putnam St., Paterson 4, N. J.*

Blenders. Specifications and other pertinent data for line of Tri-rib blenders for mixing of dry solids, solids with liquids, liquids, and suspensions. Information on accessories is included. 8 pages. *Bridges Engineering Co., P.O. Box 223, Morristown, N. J.*

"1957 Condensed Reference File," profusely illustrated, gives distinguishing characteristics, appropriate fabricating techniques, and major fields of application for polyethylenes, vinyls, phenolics, styrenes, epoxies, and polyesters —plastics supplied by the company in more than 50 different forms. 16 pages. *Bakelite Co., Div. of Union Carbide and Carbon Corp., 30 E. 42nd St., New York 17, N. Y.*

Knob catalog. Catalog No. 106 describes complete line of thermosetting plastic standard knobs. 16 pages. *Standard Parts Div., Kurz-Kasch Inc., Dayton 1, Ohio.*

Diameter control. Specifications and operating procedure for automatic diameter control with the Microlimit control wire gage for continuous, non-contact measurement of thermoplastic and rubber insulated wire; extruded tubing, rods, shapes, and filaments; and special wires. 4 pages. *Industrial Gauges Corp., W. Englewood, N. J.*

Asbestos fibres. Properties, price data, and test results of grades A-1, B-1, C-1, and D-1 Amveco asbestos chrysotile fiber reinforcing material for plastics. 4 pages. *Asbestos Div., World Commerce Corp., 445 Park Ave., New York 22, N. Y.*

"Harshaw Industrial Chemicals" Industrial chemicals available from the company listed in alphabetical order; also sales branches, offices, warehouses, and plants. 22 pages. *The Harshaw Chemical Co., 1945 E. 97th St., Cleveland 6, Ohio.*

Laboratory equipment. Standard dimensions and capacities of P-K twin shell laboratory blenders, and information on process equipment and heat exchangers designed by the company. Catalog 14. 16 pages. *The Patterson-Kelley Co., Inc., Warren St., E. Stroudsburg, Pa.*

Slitter-rewinders. Specifications and other pertinent information on Models 635 (rewinds available for 1 in.); 635 AB (rewind 13½ in., unwind 18 in.); 635 AF and BF (rewind 18 in.); and 635 AH and BH (rewind 24 inches). Bulletin 635-3. 4 pages. *John Dusenbury Co., Inc., 271 Grove Ave., Verona, N. J.*

Dry colors. Pertinent information and packaging data on Stan-Tone organic and inorganic dry colors for use in vinyl and rubber. Bulletin 02-175-4-3-57. 4 pages. *Harwick Chemical Co., 60 S. Seiberling St., Akron 5, Ohio.*

Protective coatings. Catalog on Polyken protective coatings gives advantages, case histories, applied costs, application specifications, product properties, pipe coverage data, and engineering service and packaging information. 24 pages. *The Kendall Co., 309 W. Jackson Blvd., Chicago 6, Ill.*

Machining stainless steels. Slide chart, 9¼- by 4¾-in., gives concise data on turning, drilling, tapping, threading, milling, and reaming operations on one side. The other side shows relative workability of stainless steels in a wide variety of operations including blanking, deep drawing, stamping, forging, heading, roll threading, and welding. The inserted slide moves to show at a glance the machining data desired. *The Carpenter Steel Co., W. Bern St., Reading, Pa.*

Product engineering bulletin. Property and application data on Zytel nylon resin; Alathon polyethylene resin; Teflon tetrafluoroethylene resin; and Lucite acrylic resin. 8 pages. *Polychemicals Dept., E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.*

Metallized materials. Swatch book of Mylar polyester film which is metallized, colored, laminated to a special type of vinyl and embossed in a number of patterns. The film can then be bonded to steel. 6 pages. *The Dorrie Process Co., 60 Greenpoint Ave., Brooklyn 22, N. Y.*

"Benzyl Chloride." Properties, storage and handling techniques, and varied uses of this highly reactive intermediate together with a 3-page bibliography. 24 pages. *Heyden Newport Chemical Corp., 342 Madison Ave., New York 17, N. Y.*

"Custom Molded Plastics for Industry" has chapters on injection, compression, and transfer molding, listing examples of automatic equipment used in the molding of thermoplastic and thermosetting materials at the company's newest plastics manufacturing plant in Warren. 12 pages. *Parts Div., Sylvania Electric Products Inc., Warren, Pa.*

"Care and Feeding of Rubber Rolls." Faults and the causes of faults commonly found in rubber

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rolls, together with recommended treatments; discussion of maintenance techniques, with recommendations about problems involving grooves, cracks and surface damage, lubrication, transportation, and cleaning. Roll Report No. 11. *Industrial Roll Div., Rodney Hunt Machine Co., Orange, Mass.*

Plastic laminate for printed circuits. What printed circuits are, advantages gained from their use, construction and properties of Micarta plastic laminate, and complete data for all Copper-Micarta plastic laminate types. Bulletin B-6577. 8 pages. *Westinghouse Electric Corp., P.O. Box 2099, Pittsburgh 30, Pa.*

"Emersol Stearic Acids" interprets the results of commonly performed analytical tests, discusses physical properties of commercial stearic acids and their relation to the palmitic stearic acid ratio, lists compositions of typical grades of stearic acid, and provides a stearic acid selection chart. 24 pages. *Emery Industries, Inc., Carew Tower, Cincinnati 3, Ohio.*

Fire detector. How the Kidde-atmo system operates on what the company says is a foolproof pneumatic principle and promptly triggers an electric alarm at the first unusual rise of temperature in a protected space. 12 pages. *Walter Kidde & Co., Inc., Belleville, N. J.*

"Plastics in the Furniture Industry," Study #3—A Consumer Survey on Bedroom Furniture Drawers. Basic statistics helpful in plotting the adoption of Lustrex styrene plastic drawers for case goods. 17 pages. *Plastics Div., Monsanto Chemical Co., Springfield, Mass.*

"Polyethylene Processing Tips." The selection of polyethylene resins for such applications as molding, extruding, electrical, film, coating, and specialty uses; the effect of density, molecular weight distribution, and molecular weight of polyethylene properties; data on the 12 different Petrothene polyethylene resins;

9 pages. *U. S. Industrial Chemicals Co., Div. of National Distillers Products Corp., 99 Park Ave., New York 16, N. Y.*

Products. Listing of company's plastics; alloys and metals; electrodes, batteries, and carbons; industrial gases, calcium carbide, and synthetic gems; synthetic organic and inorganic chemicals; and nuclear products together with the division or subsidiary that markets each. 12 pages. *Union Carbide and Carbon Corp., 30 E. 42nd St., New York 17, N. Y.*

Contact meter-relays. Complete information for ordering meter-relays for use in original equipment or in self-contained control packages, various circuits for providing different types of control action, and API panel meters and auxiliary control components. Catalog 4-C. 40 pages. *Assembly Products, Inc., Chesterland, Ohio.*

"Coatings Parade," an illustrated periodical, contains in this first issue articles about the marketing of resins for surface coatings, new coatings applications, and recent technological developments in the field. 12 pages. *Bakelite Co., Div. of Union Carbide and Carbon Co., 260 Madison Ave., New York 16, N. Y.*

"Overworked and Underpowered," a 23-min., 16 m.m. sound-color film, shows among other things, how a correction of 5% of the faults in a plant air system can result in 95% savings in production efficiency. *Educational Committee, Compressed Air and Gas Institute, 1400 Terminal Tower, Cleveland 13, Ohio.*

Custom molding. Catalog sheet covers company's compression and transfer techniques available for custom molding of electronic and chemical resistant products. *Epoxy Products, Inc., 137 Coit St., Irvington, N. J.*

New diisocyanate. Structural formula, analysis, properties, and suggested uses of Nacconate 310, dimethyldiphenylmethane diisocyanate, together with an infra-

(*To page 176*)



The name on the drum—STANLEY—has earned a great reputation. The drum contents help maintain that reputation. That's why, when special jobs create special finishing or molding problems, more and more manufacturers are looking to these drums for the *right* solution . . . *custom formulated* vinyl dispersions (*both* Plastisols and Organosols) that meet specific requirements.

Solving finishing and molding problems is our business . . . and has been for many years. Let us have *your* questions. We'll give you the answers.



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STANLEY CHEMICAL COMPANY*

Subsidiary of The Stanley Works

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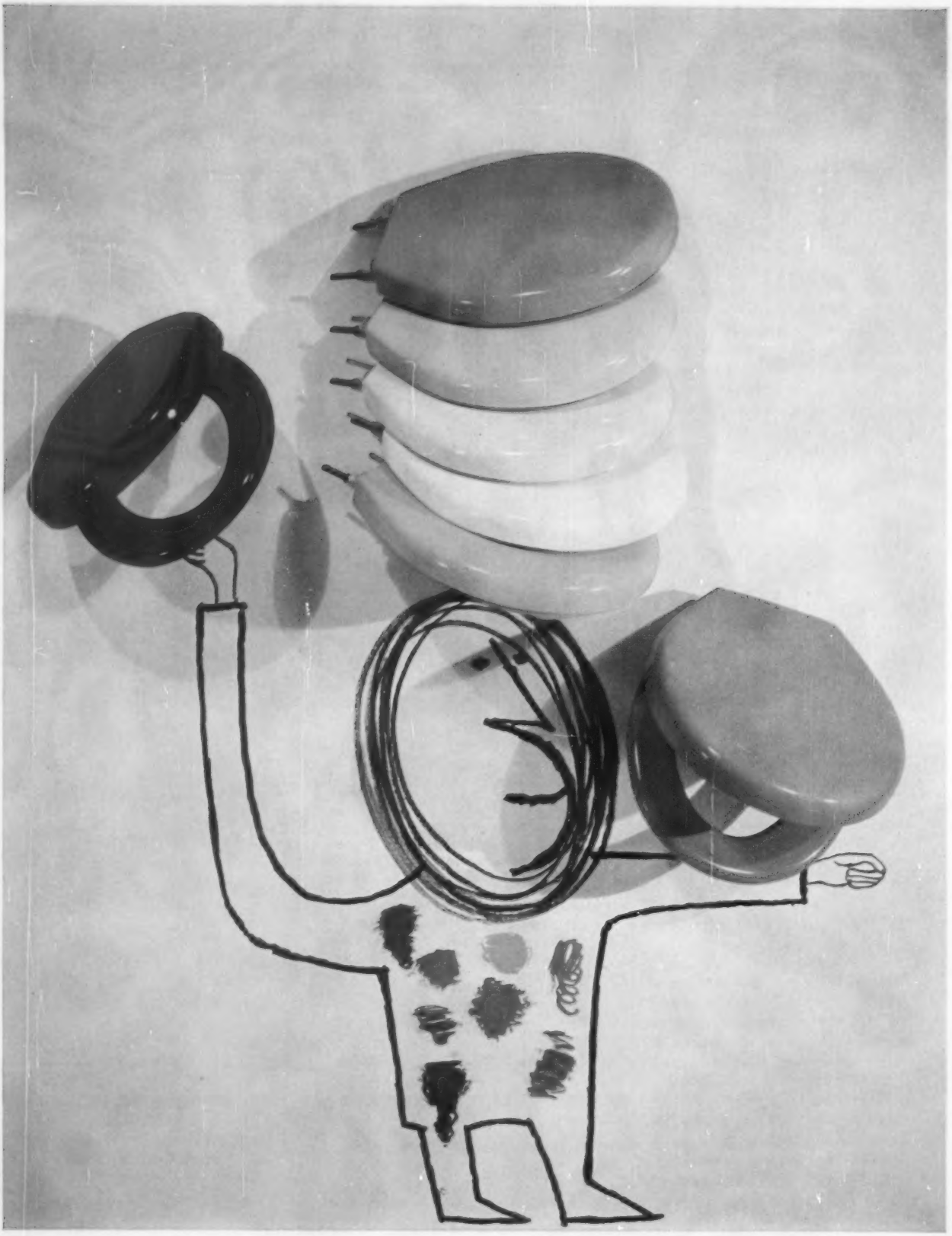
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See STANLEY first for finishes that last

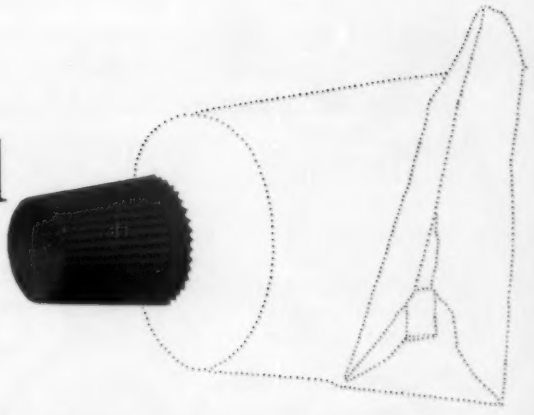
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STANLEY-JUDD DRAPERY HARDWARE • STANLEY STEEL STRAPPING



Not only the colors of the toilet seats, but also the bright hues splashed on the little figure, are among the more than 12,000 available in PLASKON Urea Molding Compound.

of toilet seats and toothpaste caps...



HERE ARE TWO VERY DIFFERENT PRODUCTS WHERE VERY DIFFERENT PROPERTIES ARE REQUIRED. YET BOTH ARE MOLDED OF *PLASKON* UREA...ONE OF THE MOST VERSATILE OF MODERN PLASTICS.

Take the toilet seat. The molder of the Teleseat* shown at left—chose PLASKON Urea for a number of good reasons. They wanted a strong, durable material with a smooth, quality surface that would not chip or peel . . . that was highly resistant to such things as nail polish remover . . . that would clean easily . . . that was available in a wide variety of appealing colors. In addition, they wanted material that had good moldability—and was suitable for molding large shapes.** PLASKON Urea met *all* these requirements as no other material could.

And the toothpaste caps. Manufacturers of quality toothpaste were looking for a material that stood for quality—had depth and richness of color, a touch and feel of smoothness—that was strong enough to take threading, was non-toxic and easy to mold. They found that material in PLASKON Urea.

What are *you* looking for in a plastic? Color? Light weight? Strength? Electrical insulation? Easy moldability? Perhaps versatile PLASKON Urea will do the job better—and at less cost! Write *today* for complete data and technical assistance. BARRETT DIVISION, Allied Chemical & Dye Corp., 40 Rector Street, New York 6, N. Y.

Allied Chemical

PLASKON® UREA...leader in the field

*Teleseat is a Registered U.S. Trademark of Sperzel Company

**MEMO TO MOLDERS—With the development of high-frequency preheating, urea has found wide use in many new, large unit moldings. Each Sperzel toilet seat takes 4 pounds, 4 ounces of urea molding compound; the tops take 5 pounds. A 10 kw. generator, operating at 60 mc., preheats the urea to 160°F. in 150 seconds.

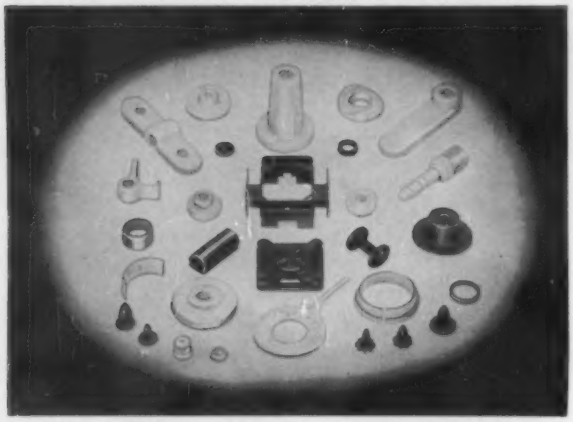
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PARTS OR FINISHED PRODUCTS



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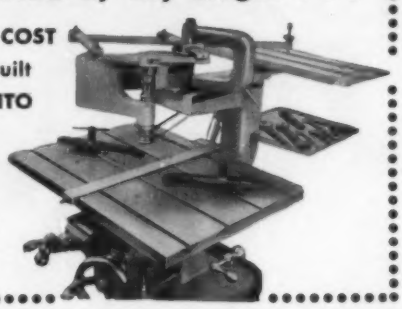
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red spectogram, vapor pressure curve, and chart showing reactivity rates in comparison with other Nacconates. Bulletin I-17F. 6 pages. *National Aniline Div., Allied Chemical & Dye Corp., 40 Rector St., New York 6, N. Y.*

Reinforcing material. Abrasion resistance, electrical properties, flexibility, corrosion resistance, weight, and other data on Troytuf, a reinforcing material of synthetic fibers bound together mechanically, without binder or adhesive. Included are prices of Dacron and Orlon Troytuf. 13 pages. *Troy Blanket Mills, 200 Madison Ave., New York 16, N. Y.*

Teflon laminated pipe. Design, construction, and typical applications of Fluoroflex-T pipe, a chemically inert, fracture-proof pipe processed from Teflon resin and fibrous glass. 4 pages. *Resistoflex Corp., Roseland, N. J.*

"Consulting Services," 16th ed. Qualifications of numbers, problems of manufacture, process improvements, research and development, plant design, and analytical and testing work in all its modern aspects. Price: $1.00. 112 pages. *Association of Consulting Chemists and Chemical Engineers, Inc., 50 E. 41st St., New York 17, N. Y.*

Automatic guiding equipment. Catalog of complete line of automatic guiding equipment—web guide power units, sensing heads, cambering roller assemblies, and automatically shiftable cradles—which can be installed in various combinations to solve almost any automatic edge guiding problem. 25 pages. *File Mfg. Co., P.O. Box 878, Oklahoma City, Okla.*

Epoxy resins. Complete physical, chemical, and electrical data together with a comprehensive discussion of handling properties and application techniques of a series of Epoxylite resin compounds designed for insulating electrical and electronics equipment. Research Report 57-100. Price $1.00. (Single copies available at no charge when requested on company letterhead.) 22 pages. *The Epoxylite Corp., 10829 E. Central Ave., El Monte, Calif.*

"Electromagnetic control," Catalog 57-S. Information on automatic transfer switches (mechanically or magnetically held), remote control switches, magnetically held contactors, relays, a.c. and d.c. solenoids, and electric plant controls. 170 pages. *Automatic Switch Co., Florham Pk., N. J.*

Correction

It has been called to the Editor's attention that a photograph from General Plastics Corp., Los Angeles, Calif., appearing on p. 131 of our March issue and showing deep drawn missile component trays was erroneously captioned. The trays in question were not manufactured from Fireban material made by The Charles Crowl Co., but were formed from 2000 Series Standard Royalite, a sheet material made by U. S. Rubber Co.

operating at 60 mc., preheats the urea to 160°F. in 150 seconds.

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Prompt and dependable delivery from the most varied stocks of plastics.
Sheet, rod and tube.

Order Eastman Butyrate (Tenite II) round tool handle stock direct from this size and color chart. We have it in stock for prompt shipment. 72" lengths.

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Diam	Ambr	Blk.	Blue	Clr.	Grn.	Red	Wh.
3/8"		V		V			
1/2"		V			V	V	
5/8"	V						
3/4"	V	V	V	V	V	V	V
7/8"	V			V		V	
1"	V	V	V	V	V	V	
1 1/8"	V	V		V	V	V	
1 3/16"	V			V			
1 1/4"		V		V		V	
1 3/8"	V			V			
1 1/2"	V						
1 3/4"	V						
2"	V						

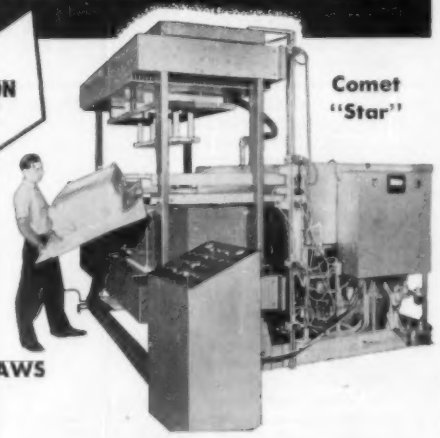
Acetate
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Butyrate
Mylar
Nylon
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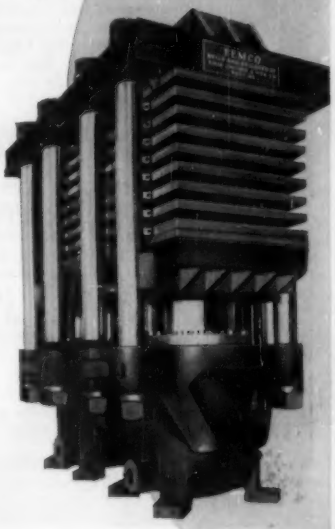
New techniques have been incorporated into this machine such as Snap Back—Pressure—Mechanical—Airslip—Vacuum Forming and Trimming in one operation.

Available in 4 standard sizes with mold areas 36" x 48" to 60" x 96". Special adaptations are available.

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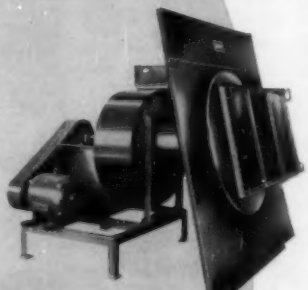
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EEMCO hydraulic presses are specially built to meet your requirements. Individual pumping units, automatic cycle and timing controls optional. Shown: 51" x 150" Laminating Press.

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Consult EEMCO for complete plant layout . . . or single unit installation.

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Low Styrene!

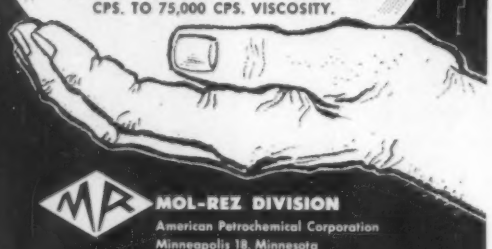
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A polyester with unusually low styrene content for maximum strength by vacuum injection, or similar methods requiring very thin resins. PLEOGEN 1302 has a viscosity of only 60 cps. at 77° F.

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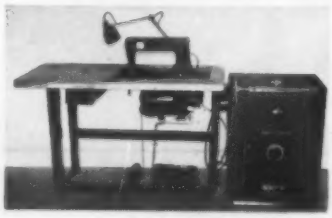


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mp Plastics

Production and sales figures in 1000 lb.* for February and March 1957

Materials	*Total p'd'n first 3 mos. of 1957‡*	*Total sales first 3 mos. of 1957‡*
Cellulose plastics:[a]		
Cellulose acetate and mixed ester		
Sheet, under 0.003 gage	4,823	4,542
Sheets, 0.003 gage and over	4,422	4,071
All other sheets, rods, tubes	1,789	1,749
Molding, extrusion materials	22,738	21,928
Nitrocellulose sheets, rods, tubes	1,185	1,199
Other cellulose plastics	1,400	1,087
Phenolic and other tar-acid resins:		
Molding materials[a]	50,868	45,264
Bonding and adhesive resins for:		
Laminating (except plywood)	15,541	11,460
Coated and bonded abrasives	4,739	4,449
Thermal insulation	12,407	12,212
Plywood	11,106	8,102
All other bonding uses¶	13,110	11,890
Protective-coating resins	8,005	6,859
Resins for all other uses	10,482	8,930
Urea and melamine resins:		
Textile-treating resins	9,818	9,981
Paper-treating resins	7,414	6,506
Bonding and adhesive resins for:		
Plywood	23,417	22,502
All other bonding and adhesive uses, including laminating	7,522	6,533
Protective-coating resins	9,632	7,595
Resins for all other uses, including molding	23,392	22,659
Styrene resins:		
Molding materials[a]	103,111	105,324
Protective-coating resins	21,574	19,775
Resins for all other uses	37,533	31,164
Vinyl resins, total[b]	201,520	195,197
Polyvinyl chloride and copolymer resins (50% or more polyvinyl chloride) for:		
Film (resin content)		25,352
Sheeting (resin content)		15,597
Molding and extrusion (resin content)		59,402
Textile and paper treating and coating (resin content)[c]		16,774
Flooring (resin content)		19,058
Protective coatings (resin content)		8,557
All other uses (resin content)		10,869
All other vinyl resins for:		
Adhesives (resin content)		9,615
All other uses (resin content)		29,997
Coumarone-indene and petroleum polymer resin:	60,346	60,563
Polyester resins:	23,070	20,305
Polyethylene resins:	158,781	148,346
Miscellaneous:		
Molding materials[a,d]	12,673	12,525
Protective-coating resins[e]	3,544	1,539
Resins for all other uses[f]	30,665	29,821

*Dry basis designated unless otherwise specified. †Revised.
‡Partially estimated. ¶Includes friction materials.
[a]Includes fillers, plasticizers, and extenders. [b]Production statistics by uses are not representative, as end use may not be known at the time of manufacture. Therefore, only statistics on total production

Production

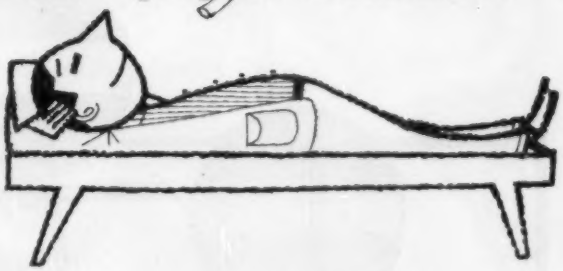
From statistics compiled by the U. S. Tariff Commission

February†		*March‡*	
Production	*Sales*	*Production*	*Sales*
1,484	1,462	1,899	1,770
1,279	1,253	1,705	1,600
529	547	648	688
7,187	7,041	8,095	7,886
429	351	379	359
375	331	500	448
15,448	14,364	17,861	14,225
4,734	3,659	5,595	3,747
1,534	1,307	1,513	1,472
3,978	3,831	3,970	4,139
3,774	2,706	3,576	2,561
4,029	3,633	4,167	3,841
2,670	2,024	2,625	2,420
3,566	3,010	3,134	2,653
3,217	3,282	3,203	3,238
2,377	2,172	2,491	2,015
7,250	7,249	8,829	7,996
2,565	2,118	2,799	2,146
2,836	2,127	3,308	2,837
7,147	6,900	8,588	7,884
33,446	31,783	37,369	37,448
6,893	6,523	7,252	6,351
12,650	9,593	13,672	11,696
64,005	63,096	70,419	67,375
	8,669		8,589
	4,564		5,272
	19,805		20,792
	5,137		5,440
	6,221		6,879
	2,682		2,798
	3,258		4,173
	3,255		3,372
	9,529		10,060
18,320	18,428	24,382	23,703
7,187	6,099	8,618	7,762
49,800	43,667	56,587	51,491
3,824	3,990	4,194	4,023
1,190	516	1,184	540
9,256	8,935	11,235	10,573

are given. [c]Includes data for spreader and calendering-type resins. [d]Includes data for acrylic, nylon, and other molding materials. [e]Includes data for epichlorohydrin, acrylic, silicone, and other protective-coating resins. [f]Includes data for acrylic, rosin modifications, nylon, silicone, and other plastics and resins for miscellaneous uses.



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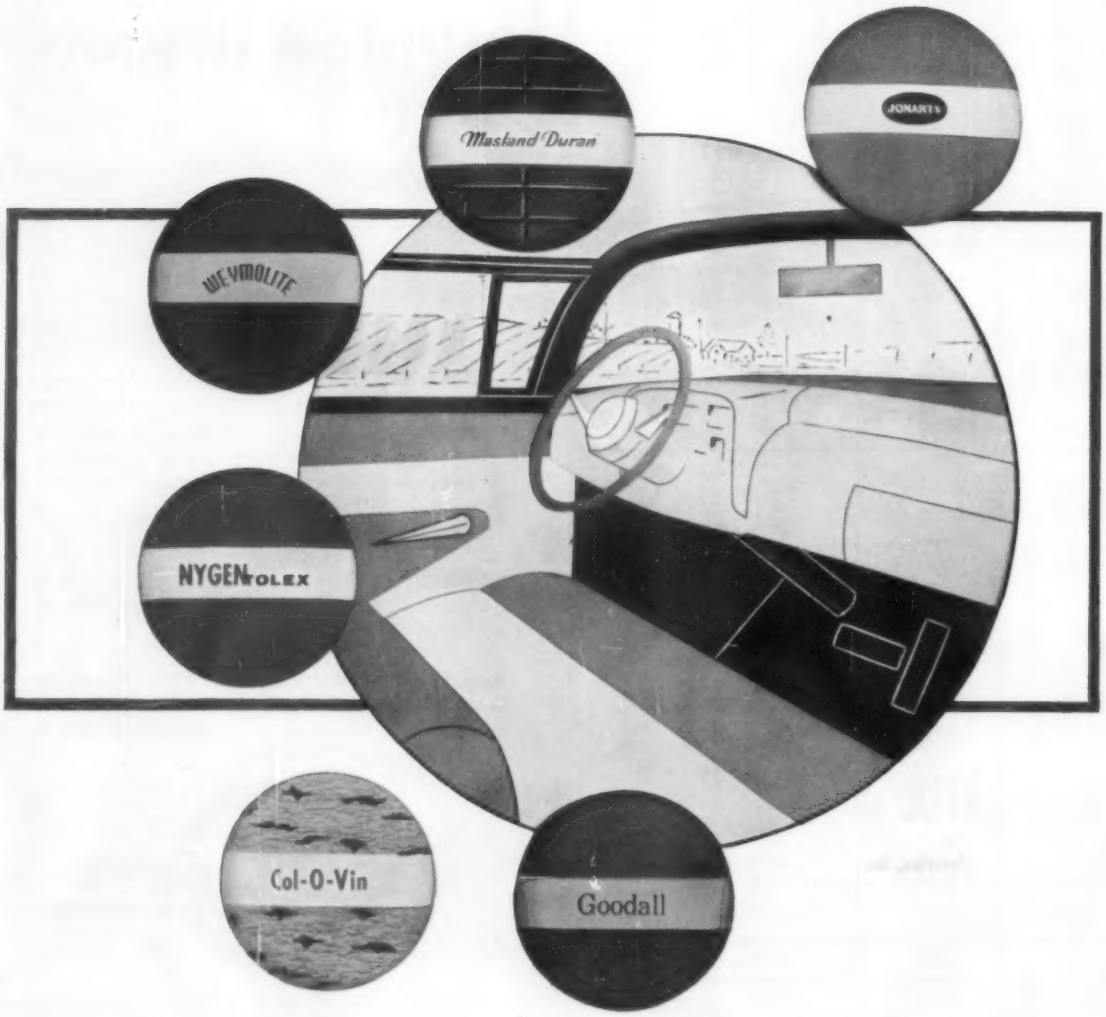
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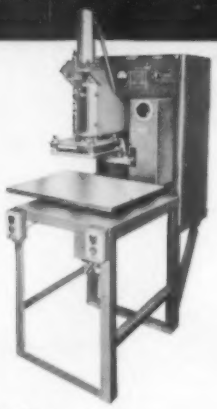
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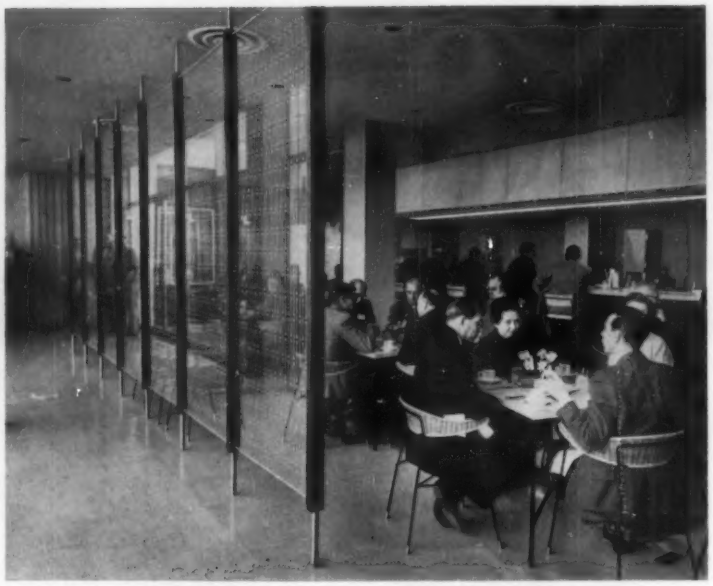
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more powerful components

Whatever the power rating you require, every Sealomatic Electronic Heat Sealer provides the full power you must have for perfect results every time. The fact is that every Sealomatic is built with electronic components that will last longer in the brutal grind of daily production. In addition, Sealomatic's ease of operation because of its many "extra" features, assures immediate full production even with unskilled help.

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Decorative panels of safety glass, with printed polyvinyl butyral film interlayer, are used in partition which forms an aisle between the restaurant area and a wall window overlooking central court at Georgia Center for Continuing Education

Printed interlayer for safety glass

Development of techniques for printing on polyvinyl butyral film now makes possible the production of decorative safety glass. This is the film commonly used as an interlayer between two sheets of glass to prevent shattering, and printing it has presented adhesion problems. The first problem was to find an ink that would adhere satisfactorily to the film; the second, to develop a suitable printing ink that would not interfere with the bond between plastic and glass in the laminated product.

Both of these barriers were hurdled by researchers of Monsanto Chemical Co., who formulated and tested several types of ink before it was found that inks based on polyvinyl butyral performed best. They then developed PVB inks in a variety of colors. Next step was to select the best process. Monsanto, working with Walter Whittum Inc., a Springfield, Mass., printing firm, found both the silk-screen and rotogravure methods applicable. For best results in the finished lamination, the film must be kept taut but not stretched during printing operations, Monsanto advises.

First commercial installation of the new decorative glass was completed at the Georgia Center for Continuing Education, a new building on the University of Georgia campus in Athens. Seven of the decorative panels measuring 40 by 96 in. were used for a partition in the building. In these panels, the printed polyvinyl butyral film was laminated between ¼ in. layers of plate glass.

Credits: Safety glass panels laminated by Libbey-Owens-Ford Glass Co., Toledo, Ohio.



Polyvinyl butyral film sample printed in flower and leaf pattern

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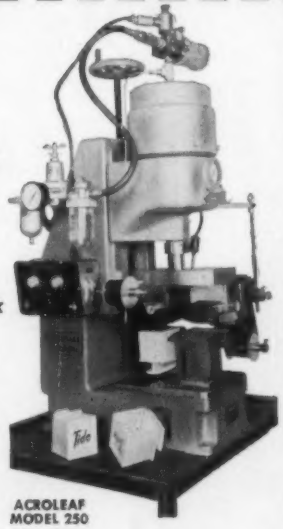
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Matched vinyl

Strict control over all phases of production has enabled Columbus Coated Fabrics Corp., Columbus, Ohio, to incorporate in its 1957-1958 Wall-Tex wall covering line several patterns with exceptionally well matched vinyl shower sets (consisting of bathroom drapes and shower curtains) and vinyl-coated cotton table cloths.

Offering materials (cotton fabric, vinyl film, cotton-backed vinyl, etc.,) with designs that match those of a wall covering is not a new merchandising technique. In the past, however, such matches have not always been the best. There were variations in color, in printing quality, in gage uniformity, etc. But with Columbus' new line, a degree of match perfection has been achieved that has previously not often been found.

The vinyl film for the shower sets is produced for Columbus by an outside manufacturer (Columbus does not presently specialize in the production of thin-gage vinyl film) to precise specifications as to weight and quality. The film is printed by four-color rotogravure and fabricated into curtains by another outside firm, again to exacting standards established by Columbus. All patterns are of Columbus design, and great care is taken that they are reproduced exactly alike on both the wall covering and the vinyl film.

The cotton-backed vinyl table cloths are both coated and printed by Columbus. First, the cotton sheeting is coated with a vinyl solution. Following that, the design is printed on the coated cloth, and then a protective layer of clear vinyl is applied over the print. "Locking in" the design in this manner makes it effectively an integral part of the table covering and assures that it is not rubbed off during normal use.

The table cloths, with perfectly matching designs, are easily cleaned with a damp cloth and withstand most food acids.

Retail prices are as follows: Shower curtains—$4.98; window curtains—$4.98; table cover, 54 by 54 in.—$3.98; 54 by 72 in.—$4.98.

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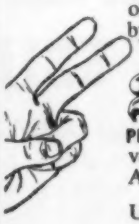
1 Don't sacrifice quality in your vinyl formulations! Don't use inadequate secondary plasticizers! Get a primary plasticizer—Polycon #40 (a pure phthalate) at the economy level.

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- Gelation and cure rates that help increase production in plastisols
- Greater toleration of filler loads

In addition, BROWN-ALLEN Polycon #40 offers a higher electrical resistivity than DOP by actual test on compounded products.



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Used in plastisols, BROWN-ALLEN Polycon #5B offers improved flow-out properties, slow gelation and fast cure in addition to low viscosity and excellent viscosity stability. This results in superior definition in complex molds.



3 Whether you buy plasticizers in drums, tank wagons or tank cars, find out about BROWN-ALLEN DOP, DIOP, ODP, DBP and DDP. Like all BROWN-ALLEN products, these plasticizers are precisely uniform, competitively priced and of dependably high quality.

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Spraying meshed cloth tape with quick-drying vinyl in construction of experimental hyberbolic paraboloid shelter

"Mothball" shelter

The technique pioneered by the Navy to "mothball" its ships and adopted later for chair construction has now been extended to shelters that are inexpensive and easy to fabricate.

Experimental shelters have been constructed in Chicago by spraying a quick-drying vinyl "cocoon" onto a tubular steel frame. The application was developed at Illinois Institute of Technology's Institute of Design under Richard E. Baringer, who believes the technique may be adaptable to housing construction.

The shelters, 12 ft. high and 20 ft. in diameter, are built in the form of a hyperbolic parabaloid to prevent wind flutter. In construction, the vinyl is sprayed onto cloth tape meshed at 6 in. intervals. White pigment is added to a second coat of pure vinyl for protection of the plastic against ultraviolet rays. As this coat hardens to the consistency of rubber, it shrinks, making the structure pre-stressed. The covering is moisture proof, does not need rigid framework, and can be applied rapidly. One of the shelters was erected in only 15 hours by two students at the University.

Credits: Vinyl supplied by Abana Products, Inc., Chicago, Ill., a distributor of R. M. Hollingshead Corp., Camden, N.J. Spraying equipment by Binks Mfg. Corp., Chicago.



Market ideas for reinforced plastics

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NOTE: Both Master Sheet Wax (Regular) and Master HT 260 Sheet Wax are available with a pressure sensitive adhesive on one side for quick and easy bonding to practically any clean, oil free surface.

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USES: Simulates part thicknesses in the manufacture of plastic dies or metal dies for plastics.
AVAILABILITY: Thicknesses from .007", in 8" x 12" or 12" x 24" sheets.
MELTING POINT: Approximately 165° F.
FLEXIBILITY: A 3/16" piece bends around a ¼" mandrel at room temperature.
OTHER PROPERTIES: Accurate in thickness (.001" ±). Follows a compound curve without forming a flat surface or varying in thickness.

MASTER HT 260 SHEET WAX (High Temperature)

USES: Ideal for use with casting and laminating resins that require or give off heat during curing. Simulates part thickness in the manufacture of plastic dies. Can also be used as a core-wax. Can be melted from finished product after curing.
AVAILABILITY: In thicknesses from .010" and in 12" x 24" sheets.
MELTING POINT: Approximately 260° F.
FLEXIBILITY: Exceptional—3/8" piece bends around a 1/2" mandrel
OTHER PROPERTIES: Accurate in thickness (.001" ±). Follows a compound curve without forming a flat surface or varying in thickness. Very tough.

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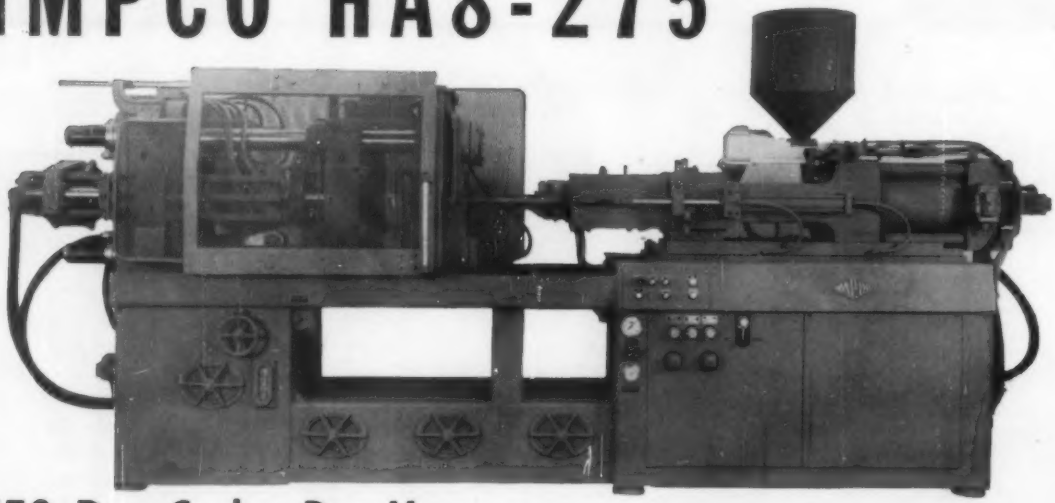


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Pipe insulation

Expandable polystyrene insulation for underground cold water pipe lines is getting its first large-scale application in a project now underway at New York International Airport at Idlewild, N. Y.

Selection of expandable polystyrene, of which some 20,000 linear ft. will be used, was based on the material's effective insulating properties, its ease of molding to specified size and shape, its good compressive strength-to-weight ratio, its low water absorption, and its competitive cost. The material's low water absorption property proved particularly advantageous since, because of the nature of the operation and the terrain it must traverse, almost the entire network of piping will be under water for at least six months each year.

Additionally, the technique of the insulation application underscores the importance of the compressive strength of the expandable polystyrene. The plastic is applied around the exterior of the wrapped pipe in a series of double semi-cylindrical sections, mopped to the surface of the pipe with a coating compound. Each pair is then wired around its outside circumference. Finally, the entire outer surface is covered and sealed with another mopping of the coating compound.

Credits: Dylite expandable polystyrene developed by Koppers Co., Inc., Pittsburgh, Pa.; insulation molded and applied by Mundet Corp., North Bergen, N.J., serving as insulation sub-contractor for Almirall Norman Co., New York, N.Y.



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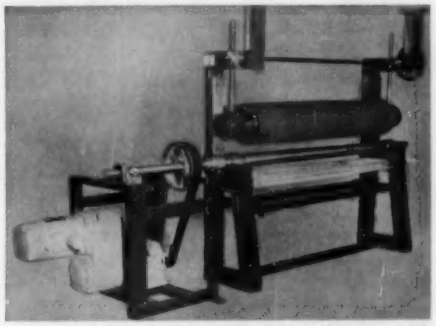
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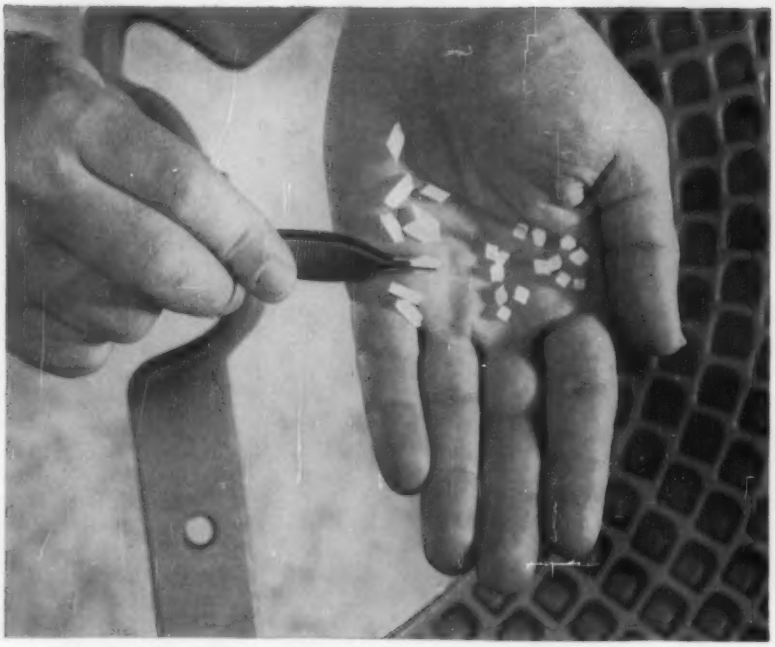


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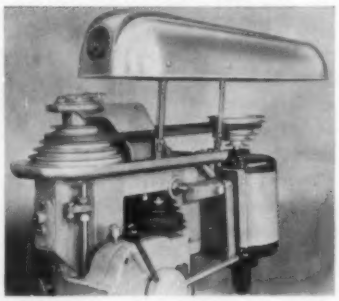
659 19th Avenue N.E. • Minneapolis 18, Minn. • Phone: Sterling 9-2417

Belt guard

There were two reasons why Rockwell Manufacturing Co. switched over to reinforced plastics for the belt guard of its new 20-in. drill press—to cut the cost of shipping the tools and to reduce operating noise.

The guard, molded of polyester resin reinforced with fibrous glass, is only 50% as heavy as a sheet metal guard of the same design. The industrial user can also benefit, says Rockwell, because the guard deadens sound of motor and belt operation and eliminates rattles, a big advantage where several tools are used in a confined production area.

The guard is molded in heated matched metal dies which include pinch-off edges to trap the material and shear the glass. The fibrous glass reinforcement is chopped and preformed from balls of roving before it is placed in the mold. Resin used is a combination of two polyesters, mineral filler, catalyst, and pigment.



Drill press belt guard is molded of fibrous glass-reinforced polyester

Although the piece part cost of the new guard is somewhat higher than its steel counterpart, the initial cost of molds is only a fraction of that of metal guard dies, according to the manufacturer of the drill press.

Credits: Molded by Molded Fiber Glass Co., Ashtabula, Ohio, of a mixture of polyester resins supplied by Hooker Electrochemical Co., Niagara Falls, N.Y., and Allied Chemical & Dye Corp., Toledo, Ohio. Glass fibers supplied by Owens-Corning Fiberglas Corp., Toledo, Ohio.

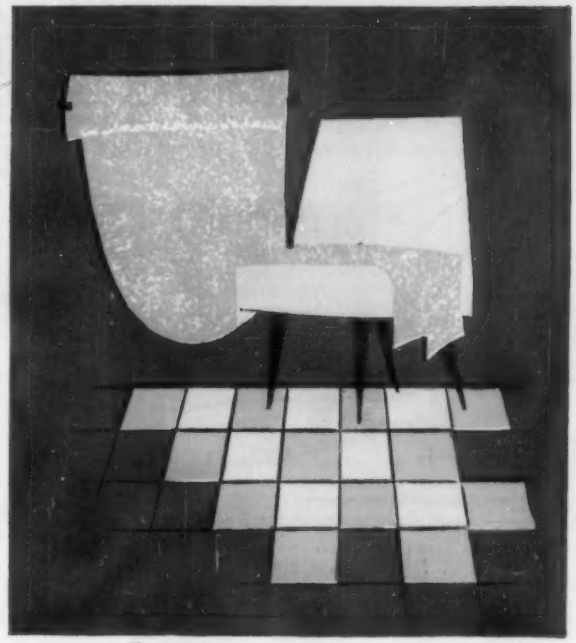
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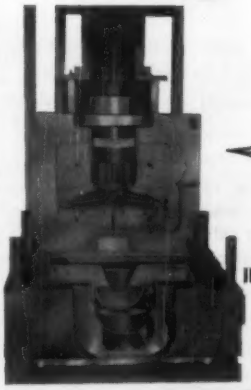
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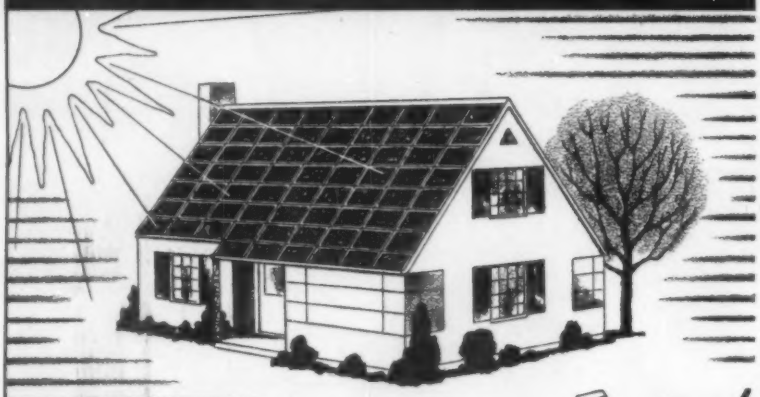


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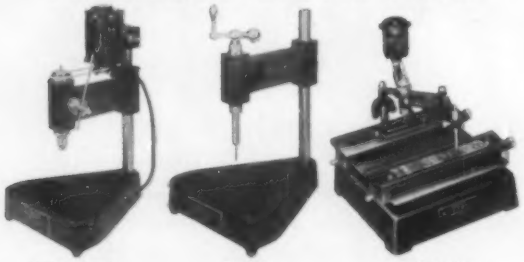


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HEAT-SEALABLE TAPE. Bulletin describes thermoplastic heat-sealable tape made of polyester resin, and suitable for bonding plastic films and non-plastic materials. Said to have excellent dielectric strength over a wide temperature range. G. T. Schjeldahl Co. (G-702)

INJECTION PRESS. Folder contains specifications and illustrations of 2¾ oz. injection press. Also illustrates compression presses manufactured by this company. Clifton Hydraulic Press Co. (G-703)

PRINTING ON PLASTICS. Illustrated literature describes hand-operated printing presses for printing on curved, uneven or flat surfaces of plastics or other materials such as metal, glass, wood. International Marking Machine Co. (G-704)

VINYL PLASTICIZER. Technical data bulletin gives information on all-polymeric permanent plasticizer for vinyl. Includes data on properties, compatibilities, compounding and applications. Harchem Division, Wallace & Tiernan, Inc. (G-705)

PROCESSING EQUIPMENT. Literature describes line of injection presses with 1, 2, 2¾ oz. capacities. Also describes company's base assemblies and a scrap granulator. The Van Dorn Iron Works Co. (G-706)

CUSTOM VACUUM FORMING. Folder describes custom vacuum forming service offered by this Cleveland company with facilities to handle sheet sizes up to 42 x 72 inches. The Vichek Tool Co. (G-707)

TACHOMETER CATALOG. 12-page catalog contains illustrations and specifications for line of tachometers for indicating changes in speed of equipment. Includes portable and mounted types. Jones Motrola Corp. (G-708)

LAMINATED PLASTICS. Folder describes Wisconsin company's custom fabrication and manufacture of laminated thermosetting plastics for electrical and mechanical applications. Includes detailed properties chart of laminated phenolics. Northern Plastics Corp. (G-709)

MELTING EQUIPMENT. 8-page booklet contains illustrations and descriptions of melting equipment for resins, potting compounds, waxes, adhesives, and similar materials. Line includes wax pots, rectangular tanks, agitators, heaters, and low pressure tanks. Sta-Warm Electric Co. (G-710)

SITE FOR MANUFACTURING PLANT. Illustrated literature discusses Gardner, Mass. as site for locating manufacturing plant. Includes data on labor supply, and power facilities. Gardner Industrial Foundation. (G-711)

CUSTOM FABRICATOR. Folder describes North Carolina company's facilities for the custom fabrication and supply of sheet, tube, and rod stock. Engineered Plastics, Inc. (G-712)

CORE MATERIAL FOR LAMINATES. Bulletin discusses use of kiln dried balsa for use with fiberglass reinforced plastics or other sandwich constructions. Includes case history applications. Balsa Ecuador Lumber Corporation. (G-713)

WOOD FLOUR FILLER. Folder describes characteristics and uses of wood flour as a filler in plastics compounds. Includes chart of physical and chemical properties, available weights and grades. Wilner Wood Products Co. (G-714)

ELECTRIC HEATER BANDS. Illustrated data sheet describes strip heater bands that supply temperatures to 700 F. Includes sizes, prices. Edwin L. Wiegand Co. (G-715)

SPRAY PAINTING MASKS. Illustrated folder describes electroformed metal masks for multi-color spray decoration of plastics surfaces. Illustrates use of different mask types. Conforming Matrix Corp. (G-716)

FINANCING MACHINERY PURCHASES. Folder describes company's plan for financing purchases of machinery and equipment. Discusses short and long term plans. C. I. T. Corp. (G-717)

SLITTERS, REWINDERS, SHEETERS. Illustrated folder describes line of web handling equipment, including score-cut slitter, rewind slitters, drum sheeters. Doven Machine & Engineering, Inc. (G-718)

PLASTISOL VISCOSITY. Reprint of Modern Plastics article discusses plastisol viscosity-temperature relationships. Includes test data. Also discusses viscosity-temperature relationship in rotational molding. The Akron Presform Mold Co. (G-719)

STABILIZERS FOR VINYL RESINS. 24-page booklet describes line of stabilizers for vinyl resins, including barium-cadmium, lead, barium stearate, cadmium stearate types. Discusses properties of each stabilizer. Witco Chemical Co. (G-720)

MOLD AND DIE MAKER. Folder tabulates capital equipment maintained by this designer and manufacturer of compression, plunger, transfer, and injection molds. Newark Die Co. (G-721)

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Plastics' green thumb

(*From pp. 89-93*)

roots. If care is taken in the initial laying of the film, it can be left in place for several plantings. Since water does not evaporate through the film, irrigation is required only during prolonged dry spells; under normal conditions, soil beneath the plastics mulch remains soft and moist.

A few years ago, fruit losses due to mold rot had almost driven the Ishibashi brothers out of business on their 12-acre strawberry farm at Torrance, Calif. Through the use of polyethylene film mulch, their harvest in April and May, 1955, increased by approximately one-third and they were able to supply 10% of the Los Angeles market with berries during the premium price season. Fruit losses due to mold rot were cut by 75 to 85 percent. Specially perforated 1½-mil polyethylene film supplied by Extruders, Inc., Hawthorne, Calif., in rolls 34-in. wide was fed from an improvised jig on the back of a tractor, then tucked in at the sides and slit with razor blades so plants could be lifted through openings.

A light gray, perforated polyethylene film has been developed to protect late-ripening tomatoes against adverse weather. The film contains a combination of nonfading metal pigments which reflect large portions of the heat rays from the sun, but allow growth-stimulating rays to pass through. Available in 500-ft. lineal rolls in 4- and 6-ft. widths, the covers are supplied in 1½-mil gage for one-season use and 2-mil for two-season use.

Introduced originally at the commercial farm level, plastic film mulches are now finding their way into specially packaged kits for the amateur gardener.

Among the firms putting out such products are Kordite Co., Div. of Textron, Inc.; Central States Paper & Bag Co.; Warp Bros.; and Cov-R-Gro's black polyethylene film, which features printed grid lines that aid in spacing seedlings. Kordite's Kordimulch film is described as a tough, specially colored polyethylene containing Polium, an ingredient specially formulated for gardening. It is made with minute perforations which allow water to reach the soil beneath the film. Jet Specialty Sales Corp., Los Angeles, has brought out Jescolite 56-F, a polyethylene formulation specially compounded for agricultural use.

Glazing for greenhouses

With polyethylene film made today in widths up to 40-ft., it has already become a "construction" material for the farm. The merits of film-covered greenhouses have been shown conclusively by various agencies, including The University of Kentucky Agricultural Experiment Station.

In a report on this work, Prof. Emmert, whose research on mulches was cited earlier, states that "seemingly these houses may make it possible to grow out-of-season crops much cheaper than in glass houses because overhead and heating costs are greatly reduced." Using two layers of polyethylene film (to trap an insulating layer of air in the roof and sidewalls of the structure), the heat build-up from the sun is not as great as under glass, but the heat loss at night is less—a desirable condition for the plants. With the double layer of plastic film, heat loss is less than half that with glass construction.

Cost of an 18- by 84-ft. greenhouse, exclusive of labor, runs between $150 and $250, including about $50 for the plastic film. This is based on the use of 0.002 in. film for the outer layer and 0.0015 in. film for the inner layer. Material for the framework, doors, and laths of low-cost rough lumber run approximately $150.00. It is estimated that such a greenhouse can be built for only ⅙ to 1/20 the cost of a glass greenhouse and costs half as much to heat.

Reinforced plastics, another type of plastic material with which farmers are becoming more familiar, also lend themselves ideally to greenhouse construction. Such panels are used in a variety of greenhouses produced by the Greenhouse Div., Jones Shutter Products, Miami, Fla. These units, built with extruded aluminum frames featuring rigid

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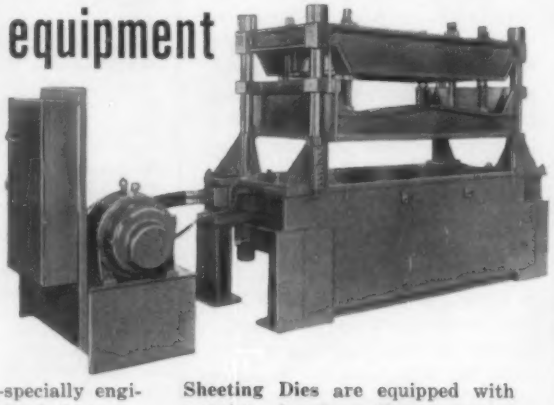
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truss construction, make use of glass cloth-polyester laminated sheets produced by Russell Reinforced Plastics, Inc., Lindenhurst, L. I., and Boca Raton, Fla. Manufactured to Jones' specifications in green and white, the flat sheets used in these units admit only the correct amounts of visible and infra-red radiation, encouraging ideal plant growth and stimulating osmosis without danger of excessive respiration.

Easy to assemble and erect, the Jones greenhouses eliminate hail damage, glass replacement, periodic painting, and other costly greenhouse maintenance. They are so designed that condensation cannot collect inside.

Latest plastic for greenhouse glazing is Polyflex 230, an oriented-extruded styrene-acrylonitrile sheet made in gages from 0.005 in. to 0.020 in. in rolls 42 in. wide by Plax Corp., Hartford, Conn. This material is perfectly transparent, is unaffected by temperatures as high as 185° F. and as low as minus 60° F., and has been Weatherometer tested for at least ten years of service life. It is declared to permit increased ultra-violet transmission and to transmit almost 100% of the sun's infra-red rays, but appears to be unique in holding back "earth radiation" in the 40° F. to 100° F. range.

As with film greenhouses, this material is so light in weight that inexpensive wood framing will suffice. One large nursery estimates that the total cost of a greenhouse made out of Polyflex 230 would be only 50¢/sq. ft. compared to $4/sq. ft. for a glass greenhouse. Air shading is required in summer months and the same water-base coatings used on glass can be applied.

As research proceeds at the agricultural schools, in cooperation with material makers and processors, many new developments in the use of plastics in agriculture may be expected. Not the least of these will be the creation of films with special strength and resistance properties for different farm uses. And with labor increasing in cost, and population increasing so rapidly, the farm is bound to become one of the biggest markets for plastics.—END

Missiles' needs

(*From pp.* 94-95)

new approach must be evolved, completely new molecular constructions should be considered as the binder for the reinforcing fibers. This is the research area that is of prime concern to the bulk of the plastics industry: development of new resin binders.

Now how do we propose to achieve an abrupt increase in strength-weight ratio? The answer is obviously a materials research effort concentrated on the missiles problem alone. The major design parameters related to the function of these materials in missile applications and which should be considered in materials research are as follows:

1. Hot-gas erosion. Reduced to simplest form this consists of a hot gas at 1500 to 5000° F. impinging on the surface at a very high velocity.

The surface or "outer material" may be either a continuation of the load-carrying skin or a distinctly separate cover of different construction and/or material. This surface material need not necessarily have excellent mechanical properties at the high temperature. It is only required that the outer layers erode slowly throughout the flight without the inner layers exceeding their mechanical properties limit. Physical properties of the chemically altered (burned) material are the key to obtaining slow erosion rates. However, it is also important that the burned deposits adhere to the base material with some tenacity, since on even a smooth surface the aerodynamic shear forces can be as large as several pounds per square inch. These shear loads will, of course, be considerably increased if the surface is rough. If the charred deposit is both a poor thermal conductor and capable of withstanding high temperatures, its growth will block the heat flow and hence reduce the internal charring rate.

2. Elevated-temperature strength retention. Current materials lose strength rapidly above 500 to 700° F. The same strength at 1000 to 1500° F. would be a significant improvement.

We have outlined the basic problem areas and a rough estimation of the required degree of improvement. We should also discuss the ways and means of accomplishing this research effort with the purpose of enlarging the existing research avenues.

Method 1: Basic materials research by recognized scientific institutions sponsored by specific grants of funds over an indefinite time period. The programs now existing are largely monitored by the military agencies and have been responsible for most of the material improvements achieved in reinforced plastics in past years.

Considerable emphasis will be placed on the basic materials research in qualified laboratories and institutions by both the military agencies and by the prime missile contractors. By this method a concentrated effort on materials can be accomplished without the pressure of immediate hardware development and all the attendant problems of design applicability which tends to narrow materials research.

Method 2: Cooperative efforts between the prime missile contractors and the plastics industry to develop specific components. Such afforts have led to many improvements using existing materials. This has been the predominant method of accomplishing industrial progress to date, but it is usually a piecemeal affair—not a concentrated or prolonged effort to obtain basic materials improvement. In fact, the schedules connected with such programs often hinder rather than encourage the use of newer high-strength materials.

Method 3: Long range research efforts privately sponsored by plastic material manufacturing companies and fabricating companies. These have also accounted for a sizable portion of the materials improvement. Such programs are privately sponsored to protect the companies' proprietary interests and are initiated to improve the product or to seek new areas of manufacturing expansion.

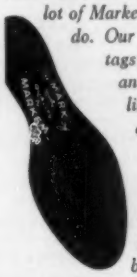
Obviously, the only practical way to increase the privately sponsored research effort is to assure a suitable market or volume to make an attractive target to shoot for—at least a target com-

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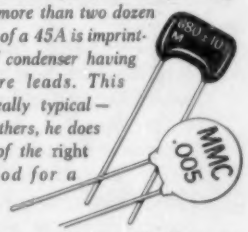
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mensurate with the required effort. In short, how much material would be used and at what price?

One way we can discuss the volume is to compare it with existing aircraft plastics consumption. Our figures and those of other companies place the average weight of reinforced plastics per airplane at around 1 to 2% of the airframe weight. If the radome and other "electrical" plastics components are removed from the airplane this figure drops sharply.

In comparing potential missiles' plastic usage with that of the airplane, we cannot elaborate, at this stage, on the specific missile applications we have in mind. Some mention has been made relative to the solid propellant motor cases and nozzles (see MODERN PLASTICS 34, 148, Oct. 1956). It is well known that certain missiles currently in production use reinforced plastic wing and control vanes. Radomes and other "electrical" applications are apparent. All these components and others under consideration could bring the total weight of structural plastic material to nearly 85% of the missile airframe.

With this figure in mind, also consider that the missiles are getting larger each year—the current missile classes will appear very small alongside the I.C.B.M. and other missile classes on the boards. The expression "a barrel of resin per missile" is used as an indication of the things to come. The number of missiles in this category can be safely left to your imagination.

There is also the matter of cost. Thus far in the missile plastics program we have found cost of materials to be secondary to strength efficiency; if currently used materials' costs were doubled or even tripled, it would not significantly alter the program. When high-production status is reached on large components, however, the cost of materials will of course receive close scrutiny.

For example, during the recent development of a high-temperature-strength polyester (triallyl cyanurate), the initial price reached $5.25/pound. This resin was used without serious question as to price on production components requiring its particular strength-temperature properties. This cost of the new polyester resin has of course dropped considerably since its introduction.

It appears, then, that the high cost of a new and improved material can be tolerated, particularly if a substantial price reduction is possible when reasonable volume status is finally reached.

This is a target worthy of the effort. The effort which will result in a missile construction capable of twice the present materials strength at elevated temperatures and resistant to high velocity hot gas erosion.

The challenge given to the reinforced plastics industry to develop such resins and reinforcing materials for missile applications is calculated to be one of the most important phases of our national defense effort. A challenge that must be accepted and brought to fruition within the next two years if our missile defense system is to remain second-to-none.—END

6000 miles of pipe

(*From pp. 100-102*)

an experimental test basis some time in 1948.

The plastic pipe carries ferric chloride, used in converting domestic and trade wastes to fertilizer. The chemical was previously piped through copper lines, but its corrosive action made repair and patching leaks in the copper pipes almost a continuous and expensive job.

Plastic has now replaced all the copper piping in the 98 rotary filters in the filtering plant of the West-Southwest Sewage Treatment Works, keystone of the district's $400 million system. The plastic piping was extended to all filters, starting with the 1948 tests, after continuous checking showed no leaks or other damage over the years.

The rotary vacuum filters, equipped with plastic pipe, are used for sludge dewatering, separating solid wastes from water or effluent. The ferric chloride is added to the sludge to coagulate solids before the sludge reaches the filter.

The liquid, a combination of water, ferric chloride and various acids, is sucked through a filter screen by vacuum, then passed off through the plastic interior piping of each filter. Each filter is 16 ft. long, 11½ ft. in diameter, and it contains 820 ft. of 1-in. plastic pipe plus several hundred drainage nozzles, lock nuts, division strips, and fittings molded from the same styrene alloy.

Resists corrosive acids

Officials of the sanitation district say the plastic pipe, also used to convey the ferric chloride into the sludge, has shown good resistance to corrosive acids and also to abrasion from sludge solids. Thick-wall copper pipe, they say, was worn down to the thickness of a thumbnail in short order under the same conditions. The lines, too, are subjected to a 30-in. maximum vacuum. Operating temperatures are around 70° F.

Success of the pipe material in the Chicago plant has been noted by water department officials across the country. In several other cities such pipe is now being put to long-range tests in filtration plants, and Naugatuck Chemical feels that this use will expand. Its performance in chemical plants also portends an expansion in this direction, they feel.

Other promising applications

This plastic pipe—33 miles of it—has also been used in the construction of a sprinkler type irrigation system for the city-owned Torrey Pine Mesa Golf Club, San Diego, Calif. This installation is stated to the biggest of its kind in existence.

Another bright note on the horizon is the acceptance of the pipe material, which chemically is an acrylonitrile - styrene - butadiene terpolymer, for use in drinking water systems. There have been some installations for this use, but the market has remained virtually untapped.

Other applications developed recently include conduit for electrical cable; leak proof liners for metal domestic gas service lines that have rusted after long use and would otherwise have to be replaced; tubing for salt water disposal wells, and the increasing use of the pipe for new domestic gas service lines.

On this last application—domestic gas service lines—Naugatuck Chemical has its eye on Texas. Almost due south of the irrigated farming district of West Texas is the town of Imperial. Big, shallow oil pools boomed Imperial a few decades ago. Then the boom deflated as the shallow pools were drained off. The oil men are now back again, drilling deep this time, and prosperity in Imperial is on the upswing. But Imperial still has a problem of sorts and, like the oil, it is in its soil.

Its soil is highly corrosive, and the metal piping used for domestic gas service lines has a short life span. So for the past year or two the utility company servicing the town has been replacing its lines with plastic pipe. More than 10,000 ft. are in now, and as more metal pipe corrodes out more plastic pipe goes in. In fact, the day isn't too far off when Imperial can boast that all the gas service lines between homes and the mains in the town are plastic. The plastic used is Kralastic.—END



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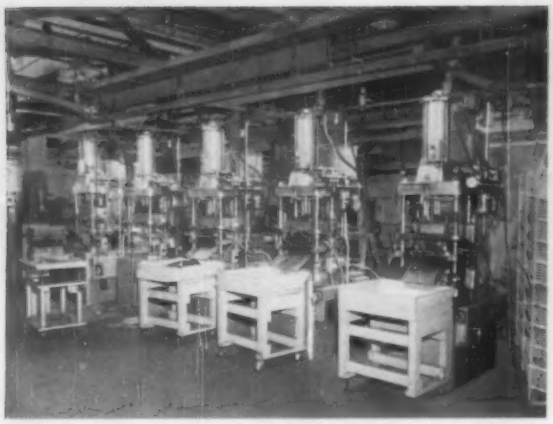
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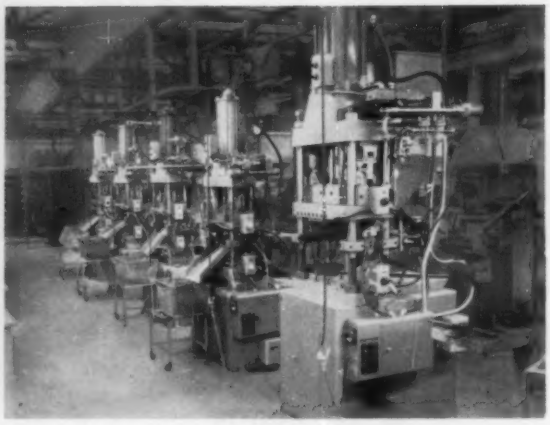
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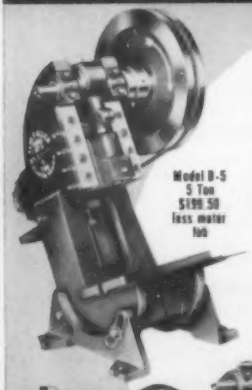
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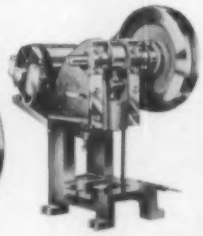


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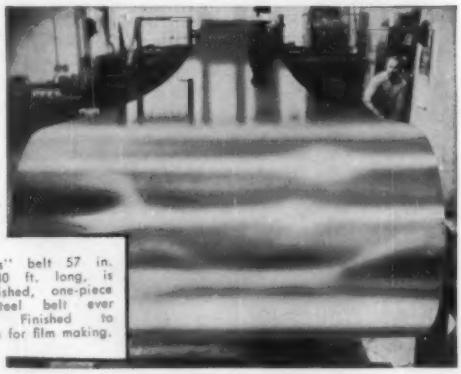
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METALSMITHS STAINLESS STEEL ENDLESS CONVEYOR BELTS

Radio-controlled

(*From p.* 103)

and starboard), the deck, and the conning tower, are vacuum formed of high-impact styrene sheet on molds and machines made by Reid; rudders and stabilizers are fabricated of the same material. All other plastics components of the vessel are fabricated of acrylic sheet and tubing. They include the snorkel tube and the housing for the operating parts of the sub, i.e., the electronic gear, motor, pump, etc.

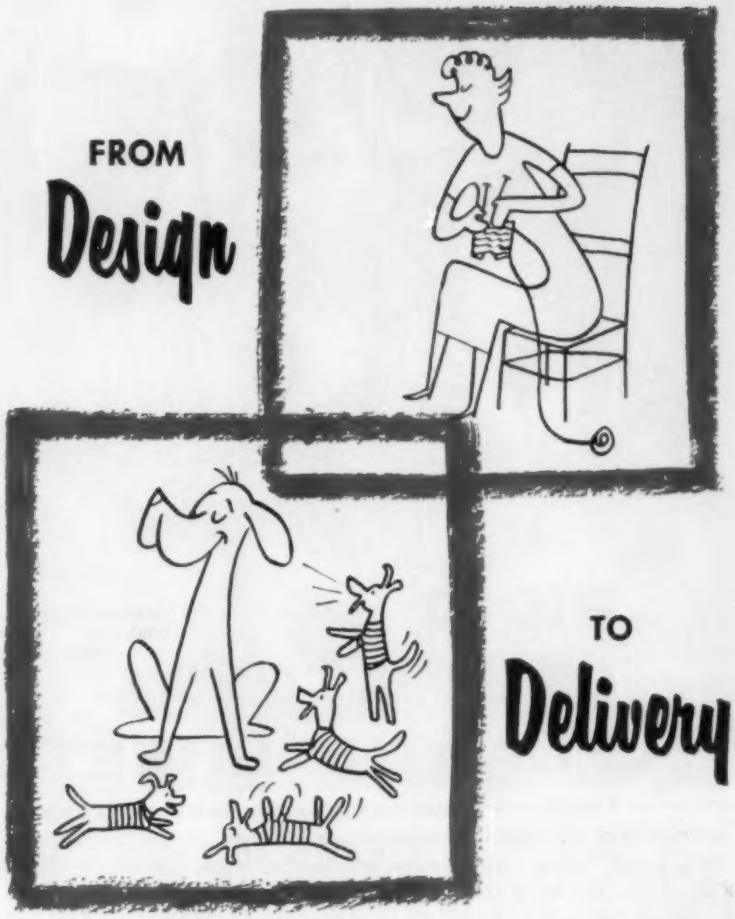
The housing consists of a 3½-in. O.D. acrylic tube 16 in. long, and a chassis which fits into it and on which the electronic and mechanical parts are mounted. The chassis is made up of four ¼ in. thick acrylic bulkheads, an ⅛-in. acrylic base strip, and four narrow magnesium bars. The bulkheads, with threaded holes on sides and bottom, are attached to the magnesium bars and the acrylic base by means of screws, and act to compartmentalize the housing and prevent the components from moving about during the operation of the sub. Holes drilled through the faces of the bulkheads accommodate wires, hose, roller bearings for shafts, and the like.

After all components are mounted on the chassis, it is slipped into the tube which is then sealed with fabricated acrylic caps at both ends. The snorkel tube is cemented to a bushing located around a hole drilled through the top of the housing. A whip antenna is inserted through the snorkel tube into the housing where it is attached to a mounting post by means of a pressure fit.

The two sides of the hull are assembled with brackets and screws and the complete housing placed into the assembled hull. The deck and conning tower are then secured over the hull. A hole drilled into the conning tower permits passage of the snorkel tube top.

Now propellers, rudders, and fins are assembled, and the craft is ready to be launched.

Credits: Acrylic sheet and tubing by Cadillac Plastic and Chemical Co., Detroit 3, Mich.; impact styrene sheet by Sandee Mfg Co., Chicago, Ill.



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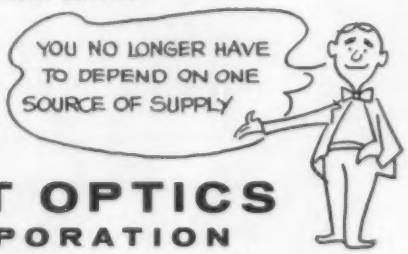
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A problem in geometry

(*From pp. 96-98*)

walls of required dimension and in proper position on the curvature, and in this approximate rectangle laminating the polyester-glass structure in a manner similar to that used in making the master male die.

In laminating the section a blue tinted white gel coat comprised the surface coat followed by a layer of style 1000 glass cloth that was saturated with polyester resin.

Then there followed one layer of cellular cellulose acetate ½ in. thick layed in 4- by 4-in. blocks or tiles.

This was then covered with one layer of 2-oz. polyester-bonded glass mat and, after saturating with resin, the whole laminate was drawn into contact with the die surface using p.v.a. sheeting as a vacuum film and evacuating the air and excess resin. Fig. 6, p. 98, shows a completed laminate as removed from the mold, and before the framework has been attached to it.

Special framework designed

It was anticipated that provisions would be necessary for adjustment for expansion and contraction, as well as curvature of the sections.

To make such adjustment possible a framework was designed on which the sections would be fastened flexibly by means of sheetmetal screws passing through clearance holes in the frame, then through rubber grommets or cushions, and screwing into the fibrous glass-reinforced polyester laminate backing—diagonally and around the perimeter of each section.

Thus when assembled the surface curvature could be adjusted against a templet by screwing in or backing off the screws as required to reproduce the earth's curvature to scale.

Another part of the framework, shown in Fig. 7, consists of a structural unit so designed as to interconnect adjoining sections. In addition, this unit was designed with provisions for adjustment of the relationship of the sections with each other.

A rear view of the sections that are being assembled is shown in Fig. 8, p. 98.

Close adherence to tolerances

In checking the assembled sections for adherence to dimensional tolerance, the following facts were noted:

1) Variations in curvature (after adjustment) ±.030 as checked against templet.

2) Maximum actual measurement of any of 3 equal sides of any section was found to be 65.672 in. or 0.003 in. in excess of computed length.

3) Minimum actual measurement on any of 3 equal sides of any section was found to be 65.641 in. or .028 in. less than computed length.

4) The accumulated error along the line of the horizontal joint as assembled was found to be 0.129 in. in excess of computed value, part of which accrued in the interval of the joints.

5) The maximum actual measurement on the remaining side of any section was found to be 63.469 in. or 0.038 in. in excess of computed length.

6) The minimum actual measurement on the remaining side of any section was found to be 63.406 in. or 0.025 in. less than computed length.

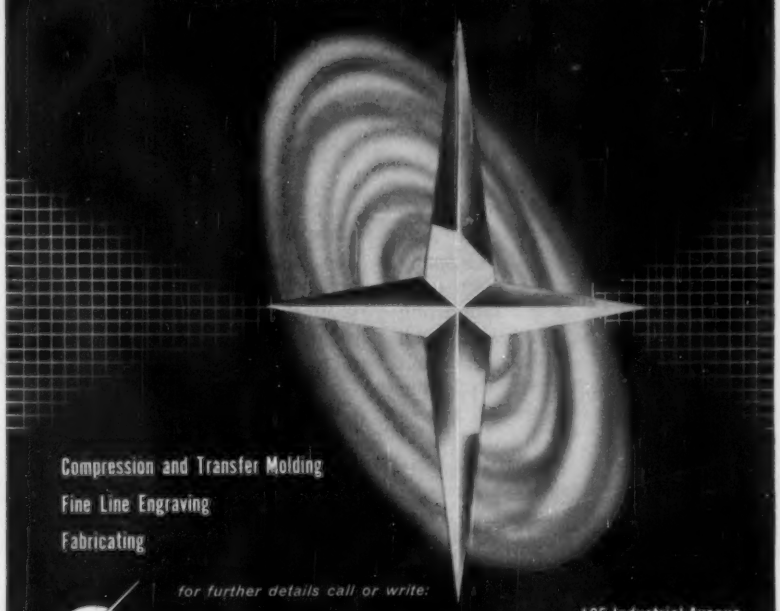
7) The accumulated error along the line of the small circle (top and bottom) of the assembly was found to be 0.086 and 0.120 in., respectively in excess of what it should have been on the basis of computed value, part of which accrued in the interval of the joints.

The eight completed sections were turned over to the Topographic Engineering Department for continuation of mapping studies.

Although there is no requirement at the Engineer Research and Development Laboratories for a complete sphere, the engineers and technicians who participated in the program would welcome a requirement which would justify further research.

Certainly, to construct a complete sphere 42 ft. in diameter presents an irresistible challenge and would indeed prove to be a highly impressive bit of plastics engineering.—END

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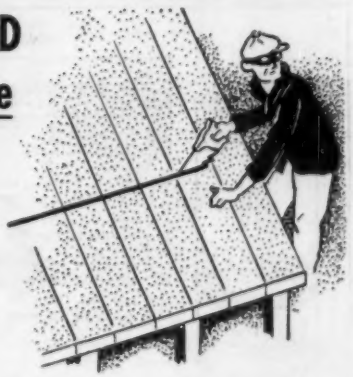
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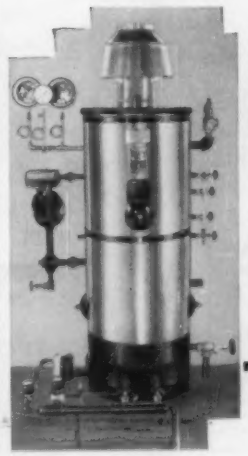
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Atomic attack

(From pp. 104-107)

except black, remained unaffected with no surface change at Station 1. One black sample, however, warped and exhibited a degree of slight melt.

Melamine dinnerware: These samples, hung at all three Stations, remained unaffected and undamaged.

Polystyrene tiles: These materials were submitted by several companies. Each company mounted a range of colors on a board backing. It was interesting to note that the white and pastel shades exhibited but slight melt at the three Stations, while the darker shades exhibited severe melt.

Epoxy high-heat-resistant laminates: These samples remained undamaged, but with slight loss of gloss.

Conclusions

It was quite evident that color (or probably infra-red reflectance) is a major factor in the behavior of plastics under the influence of thermal effects that are generated by a nuclear device.

Throughout the evaluations, white and transparent samples exhibited less distortion, char, and melt than did the darker colors. For instance, the black samples were affected to a greater degree in all cases; dark blues and reds to a lesser degree, etc.

The effect of thermal radiation varies widely with thicknesses, depending upon the thermal characteristics of the various families of plastics.

There was no difference in the effect of the half-backing used for the elastomeric type plastics at either Stations 1 or 2. If a material melted at either of these two Stations, it was a complete melt.

However, at Station 3, where somewhat less thermal radiation was present, those materials which had melted at Stations 1 and 2 usually melted at the unbacked portion.

Because of extreme blast damage to the test houses, it was impossible in all cases to examine the plastics products placed in them for test; but the few plastics articles which were observed remained in an undamaged state.

However, these, like a number of other lightweight articles in the homes, were widely scattered by the blast.

The Society of the Plastics Industry would highly recommend that in future industry participation tests with nuclear weapons serious consideration be given to the use of plastics as glazing, skylighting, and awning materials in the construction of homes and industrial buildings on the test site. This recommendation is made because of the extreme susceptibility exhibited by glass to blast destruction.

It is assumed that the plastics industries will participate in future nuclear experiments and by so doing be in a position to refine test programs in order to obtain results of a more quantitative nature.—End.



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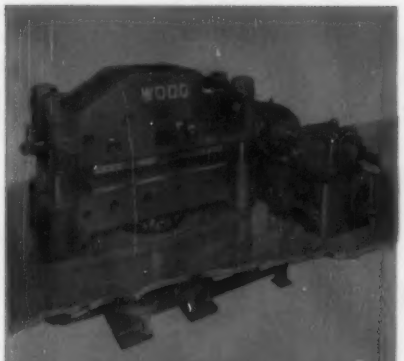
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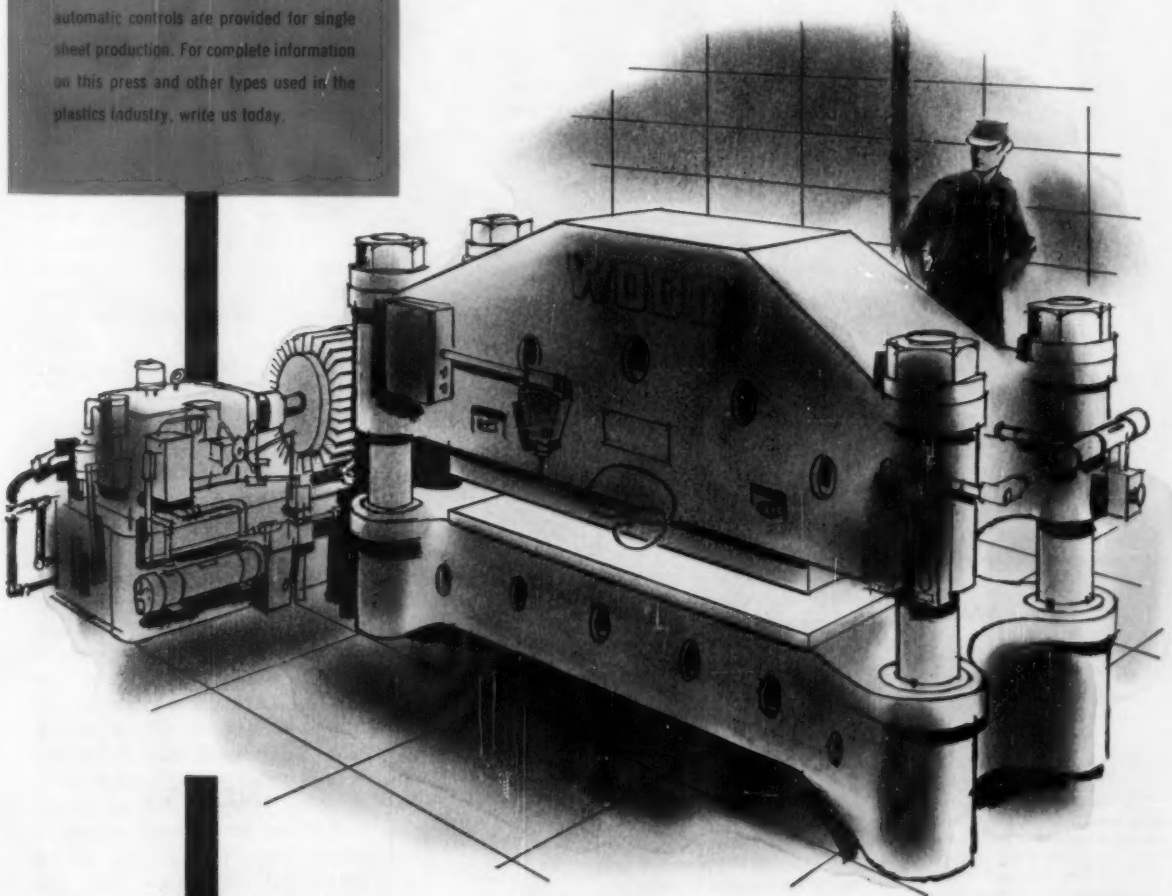
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Rubber tools

(*From pp.* 115-116)

tion methods give good results where parts have been made with other types of tooling.

Laminating materials

Glass fabrics pre-impregnated with polyesters or phenolics have proved to be the most satisfactory laminating materials for use with rubber tools. Wet layups, such as those obtained with modified, high-temperature polyesters, suffer from the fact that the pressure exerted by the rubber tool is not the same in all parts of the mold. The wet resins flow in such a way that bond strength is poor in the resulting resin-poor areas. However, acceptable moldings *have* been made from epoxy layups.

Cast steel, aluminum, and zinc tools have performed well in making a variety of moldings with mated rubber pressure pads. Those comprising aluminum had the most rapid heat transfer rate, but couldn't be used to make close-tolerance parts because of their high thermal expansion rate. Zinc-alloy tools have a good heat transfer rate and can produce limited quantities of close-tolerance parts, but tend to grow.

Production life of tools

Chrome-plated steel tools have a relatively low heat transfer rate and are in many instances too heavy to be handled with maximum ease. But their use is definitely indicated where good release characteristics and stability are needed to assure long tooling life and close-tolerance production. Where long production runs are to be made it may be necessary to replace the rubber mating tools. Evidence to date shows the rubber mate can be used to produce up to about 500 moldings, and it can be replaced at least a dozen times for the cost of an equivalent metal tool. Thus the point of cost equality with machined metal tooling is a run length of about 6000 pieces.

On the other hand, this new tooling technique is considered economical for the production of less than 12 identical aircraft parts where the qualities of compression moldings are required.—END

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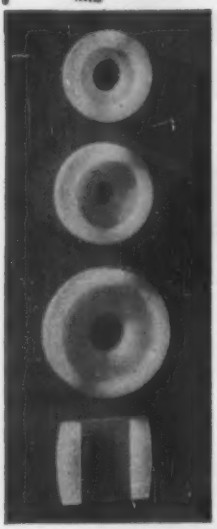
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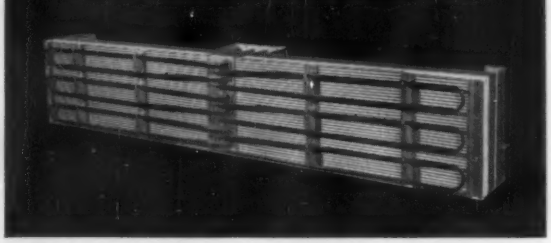
Pictured are 3 Sinko Nylon cabinet rollers and a drawer skid-block that are being used successfully by several leading manufacturers of fine kitchen equipment. Sinko Nylon was selected after a series of exhaustive tests had proven its superiority in every respect. In one experiment a small drawer equipped with Sinko Nylon rollers was loaded and automatically operated the equivalent of a normal 200 years service. Upon examination the Sinko Nylon rollers showed little sign of wear.

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C-2114

Vinyl foam

(*From pp.* 117-118)

quality of the foam. Prolonged recirculation of the carbonated plastisol in the reservoir, as well as settling in the piping over long periods can cause slight density changes. It is therefore wise to empty the reservoir if the demand is to be interrupted for several hours or longer.

Molding the foam

In contrast to the foaming of polyurethanes, where two chemical components must be accurately, thoroughly, and quickly mixed, a simple nozzle suffices for foaming the carbonated vinylsol. A needle-valve-type gun attached to the supply line injects a given amount of material into the mold. The amount may be judged visually or, if greater precision is needed, any of several metering devices can be used. The filling time is usually no more than a few seconds, helping to speed mold turnover.

Continuous slab can be produced by foaming from a manifold nozzle onto a moving belt. The fresh foam then passes through an HF heater where it is fused in about one minute or less. Closer control of thickness can be maintained if top belts are used, too. Where heat loss from the exposed surface is a problem, hot-air heating can supplement the RF generator. After fusion the slab is air-cooled until firm. The whole slab-making unit can have an over-all length of less than 30 feet.

First unit goes on stream

The Chromcraft Corp., St. Louis, is now mass-producing molded foam cushions for use in its kitchen and dinette furniture, thereby gaining the distinction of being the first large-scale "captive" vinyl foam molders. The foam is supplied from a Fay Foamer at rates up to 400 lb./hr., in the density range of 6 to 7 lb./cu. ft., which gives the cushions the necessary support and comfort characteristics. Independent laboratory tests show that these vinyl foam cushions can be expected to keep their shape and resilience for the lifetime of the furniture, even under extreme conditions.

Vinyl formulations offer other attractive properties in upholstery, aside from the cushioning ability of the foam: good resistance to water, detergents, and household chemicals; non-flammability; and relatively low permanent set.

Only six weeks were required at Chromcraft for installation, training of personnel, and stepping up to 3-shift operation. In this particular plant, where individually molded cushions rather than slabs are being made, the foam-filled mold is conveyed through a forced-air convection oven operating at 325 to 375° F. to fuse the vinylsol. Cooling is accomplished along the return cycle of the endless conveyor. Figure 2, p. 118, shows the foaming and unloading operations, while Fig. 3, p. 118, shows (in the background) the opposite end of the mold-rack conveyor.—END

Heat-aging

(*From pp.* 141-148)

the contribution of the cohesive strength of the binding resin becomes a negligible part of the total strength exhibited by the laminate.

On this basis, then, Fig. 4, p. 148, has been plotted for the purpose of comparing the expected lives of the TAC and HE laminates of this study.

The plotting points are taken from the time-scale identifications in Figs. 1 and 3. A second life-line for HE laminate is included in Fig. 4 as a precaution against using this chlorine-containing material in applications where corrosion of associated metals may be a problem. This line indicates the time at which appreciable quantities of chlorine will have been released by the polymer(6). The 20-yr. continuous operating temperature for TAC laminate is about 125° C. In terms of chlorine release, the HE laminate appears to be safe in dry heat up to a temperature of 135° C. However, considered in terms of flexural strength this material appears to be good up to 155° C.

Acknowledgments

The writer is indebted to Messrs. T. J. Jordan and H. T. Plant of the General Engineering Laboratory for selecting and preparing the laminates, and to Messrs. L. S. Lazer, W. V. Olszewski, and Mrs. W. G. Spodnewski, also of the General Engineering Laboratory, for conducting the experimental work in connection with this study.

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The Plastiscope

News and interpretations of the news
By R. L. Van Boskirk

Section 2 *(Section 1 starts on p. 41)*

Polystyrene price problems

At the time of going to press, no one knows for sure just when the price of polystyrene is going to settle down as a result of the styrene monomer-for-rubber price reduction in effect July 1. Every major producer is watching his competitors with a wary eye. When one of them reduces a price, another won't like the pattern and will offer his price schedule in different form, if history repeats itself. The consequence may be a series of changes over a period of time, with prices varying according to the type and quantity of material purchased.

Styrene monomer for rubber has been selling for 16¢, which is 4¢ less than the more highly refined grade used for producing polystyrene. From July 1, the rubber-grade monomer will be sold for about 12½ cents. This arrangement was made more than a year ago when Firestone announced it would build its own styrene monomer plant and other rubber companies also indicated they were so inclined. Some of the styrene producers evidently sought to forestall this move and keep monomer production in the chemical industry. They offered monomer in large quantities at a price which they believed was less than the cost at which rubber companies could produce it in new plants; chemical company plants had already been amortized. Apparently a 12¢ price with an escalator clause was agreed upon; the escalator would permit a raise based upon rising costs.

Purity is the key. There has always been a differential of 4¢ or so between monomer sold for rubber and that sold for polystyrene. Styrene monomer for rubber is 99.4% pure; that for polystyrene must be at least 99.7% to minimize crazing in the finished polymer. It is claimed that in order to get that extra few tenths of 1% purity, it is necessary to slow down production about 20% —hence the extra cost. How long this two-price situation will exist is a question that can only be answered by future developments.

It is generally believed in the trade that so-called rubber-grade styrene monomer has always been used in polyester resins, in some of the coating resins, and in many of the high-styrene-butadiene grades used for rubber reinforcement and other purposes.

Since polyester resins that require styrene use less than 2% of all styrene monomer produced in the United States and since polyesters contain less than ⅓ by volume of styrene, it is difficult to foresee that they will be seriously affected by a 4¢ price decline in monomer. For further discussion of this angle, see the Editorial on p. 5.

High-styrene-butadiene resins for coatings and other products contain from 60 to 80% styrene. Total production of such resins in the United States is around 200 million pounds. Several producers buy both styrene monomer and butadiene; others produce either styrene or butadiene and purchase the other ingredient. The over-all effect of a 4¢ styrene monomer drop on producers of high-styrene-butadiene resins is therefore unpredictable. It is worth noting, however, that the coating resin producers could take advantage of it to help meet the ever-growing competition from other synthetics.

Supposedly, the polymer price drop from 30½ to 27½¢ last September, after a price increase just a few months before, was in anticipation of the monomer price decline. How much lower it will go may depend upon a battle of nerves between the producers. Perhaps they will pick away at fractional penny reductions or maybe one of them will lower the boom and end future uncertainty.

There is a general feeling that a producer needs a 10¢ differential between monomer and polymer price in order to make a reasonable profit; that may be the key to the present price situation. Producers' prices in large-volume commodities are often determined by counter-balancing factors. One is how much profit margin they can shave off to keep out potential competition; the other is that the differential must be high enough to make a profit. The polystyrene price structure will undoubtedly be compromised by that conflicting situation.

Periodic fluctuations in sales volume of polystyrene have already been somewhat affected by price uncertainties. Sales in the second quarter of 1956 were around 105 million lb. (not counting volume of one producer who didn't then report his sales to the Tariff Commission), which was a bit higher than the previous record breaking last quarter of 1955. That second quarter volume in 1956 was probably caused by an advance notice that prices were to be raised, which gave molders a chance to build up their inventories. Sales for the third quarter then dropped to 90 million lb.—the lowest on record since 1954. This decline occurred despite the 3¢ price reduction on September 1, 1956, which knocked down the previous raise. The last quarter of 1956 moved back up to around 95 million lb. and the first quarter of 1957 was up to 105 million lb. again, which was slightly better than the first quarter of 1956 and about 10 million more than the first quarter of 1955. However, it should be noted that the pro-

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ducer who didn't report in 1955 and 1956 is now reporting to the Tariff Commission and his increment accounts for part of the increase.

Most analysts believe that the big sales volume in the first quarter of 1957 was an indication that the molders' inventories built up in 1956 have been completely dissipated and that 1957 purchases of polystyrene have been entirely the result of orders in hand. If such is the case, 1957 may be another record breaker, even though at this date sales for the second quarter of 1957 do not look quite as promising as for the first quarter.

Not even a man with the brain of an Einstein could figure out what is going to happen volume-wise in this polystyrene industry of fluctuating prices, changing markets, and shifting periods of production volume by customers who buy polystyrene molded items or parts. An encouraging factor mentioned by one sage observer is: "Properties of plastics often become a mighty lot better for a penny a pound less cost."

New polyethylene resin

A new polyethylene resin for use in making heavy sheet for thermoforming has been introduced by Du Pont. Designated Alathon 31, the resin is said to give manufacturers a composition which is easily extruded into sheet yet has a high enough viscosity to resist sagging during the preliminary heating step of the thermoforming process and to be shaped into finished parts when drawn down over the thermoforming mold.

Alathon 31 has a melt index of 0.6 and a density of 0.930; this gives a high degree of stiffness to the finished part, or permits reductions in costs through the use of thinner wall sections.

According to Du Pont, parts made of Alathon 31 have glossy surfaces and are resistant to environmental stress cracking. They are also essentially free of taste and odor, and are completely non-toxic.

Alathon 31, packed in 50-lb. multi-ply paper bags, is currently available at 41¢ per lb. in minimum truck loads.

Twenty-five years in plastics

A quarter of a century is a relatively short span in the life of almost any American industry, but a man or company which has been in plastics for 25 years is a real, real old timer. In this year of 1957, the division of Eastman Kodak Co. handling the sales of molding compounds, now known as Eastman Chemical Products, Inc., subsidiary of Kodak, is 25 years old.

The company introduced cellulose acetate to the commercial market as a self-extinguishing safety film for home movies in 1923. In 1932, Eastman developed cellulose acetate molding material without using solvents, a then new method that reduced manufacturing time from hours to minutes and gave great impetus to acetate as an economical molding compound. The tradename Tenite was then adopted. In those early days, the material was compression molded, but Eastman pioneered in the development of injection molding machines in its own plant and helped teach molders how to use them.

Eastman later expanded its plastics operation by introducing cellulose acetate butyrate in 1938 and polyethylene in 1954. Eastman added a new feature by producing spherical pellets, and is thought to have been the first polyethylene producer to provide color concentrates. Up to that time, polyethylene was generally tinted with dry colorants.

Eastman Kodak, the parent company, has a sales record that has grown from $415 million in 1948 to $762 million in 1956. Seventeen cents out of every one of those dollars came from cellulose products and plastics in 1956. The parent company spent $58 million for replacement, improvement, and expansion in 1956. Since 1945 about $48 million has been invested. About $60 million will be spent in 1957. All this investment has been from company funds. Of the 1956 amount, 34% was spent in Kingsport, Tenn., and Longview, Texas, where fibers, plastics, and chemicals are produced.

Since Eastman Kodak is a specialist in color and since color has been a major factor in the appeal of plastics, the Eastman-Plastics marriage has resulted in a most happy family life. Spencer E. Palmer, vice president of Eastman Chemical Products, in commenting on this 25th Anniversary says:

"One of our chief interests has been in enlarging the range of colors in which plastics can be used. In those early days the tendency in plastics was to imitate conventional materials. Today there is little or no emphasis on imitative coloration—plastics' vast inherent color potentialities are now being exploited.

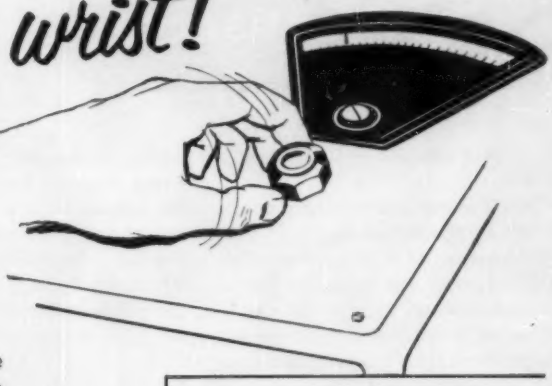
"But in some of the newer plastics, creative use of color is lagging. For example, polyethylene film has ben largely confined to natural transparent.

"Now, however, we are on the verge of seeing color make a manifold improvement in the appeal of polyethylene film. Colored film has presented several production problems—one has been to maintain evenly dispersed color in a transparent film. Any agglomeration of pigment particles shows clearly, so that the coloring agent must be homogeneously dispersed. And for extended runs, a ready means of assuring color matching and color control had to be available to extruders of polyethylene film.

"To overcome these problems, we suggest use of our color concentrates rather than dry pigments. These concentrates are pellets of deep color pre-dispersed in polyethylene so that complete compatability of the plastic and the colorant is assured and 'freckling' of film cannot occur. The concentrates also make it possible to get exceptionally well dispersed color in

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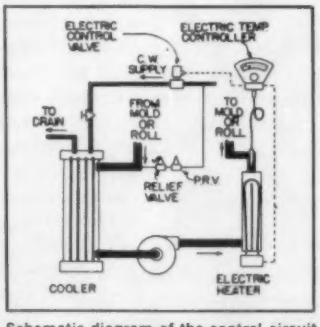
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4. **Individualized heat exchanger adjustment**—large heat exchanger with cooling water flow control valve permits adjustment to individual application for best results.
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6. **Water and electricity saved**—cooling water and power consumption dependent on demand. When temperature stabilizes, neither water nor power is consumed.
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large polyethylene molded products."

Mr. Palmer has touched upon a highly significant factor in the development of future polyethylene markets. His company's accomplishments in the development of a tremendous range of color for acetate has helped make Americans particularly conscious of color in plastics. The public expects the same thing in polyethylene, which up to now has come nowhere near matching the variety and brilliance of color shown by other thermoplastics. Furthermore, new markets for polyethylene must be obtained in order to consume present and future polyethylene resin production. More color, particularly in film, should be a most helpful stimulator in obtaining those markets. Eastman's 25th Anniversary could well be another milestone in polyethylene history if it starts off a big upsurge in demand for brilliantly colored polyethylene.

Fluorine polymer for small-scale coating

A polymer of trifluorochloroethylene, with low loss dielectric properties and excellent chemical resistance to acids, alkalies, salts, and organic solvents, is now available in aerosol containers for spray-coating of small metal and ceramic items. It is said to be the first thermoplastic material of its type to be successfully packaged in aerosols.

The product, designated Polyfluoron and produced by Acme Resin Corp., Forest Park, Ill., from a Du Pont monomer, is recommended for small-scale operations and laboratory test work. Acme also suggests that the aerosol package can provide an inexpensive yet efficient method of evaluating performance of the spray coatings without heavy initial investment in spraying equipment and bulk resin material.

Typical applications of the aerosol-dispensed resin coating, which requires heating to 480° F. for fusion, include corrosion-resistant lining of tanks and pipes, general maintenance finishes where equipment is exposed to corrosion, moisture sealing, magnet wire insulation, and chemical valve lining. Typical small items for which the aerosol package provides an ideal coating medium include stirring rods and agitators, laboratory containers, aluminum beakers, silicon rubber gaskets, bus bars, bobbin guides, thermometer stems, high-frequency coil dielectrics, resistors, and valve floats.

For better rainwear

A lamination of Velbex flexible p.v.c. and Terylene polyester woven fiber, produced by BX Plastics Ltd., London, England, bids fair to have a strong impact on the rainwear and other fields. The new material is suitable for h.-f. welding as well as sewing; it has high tear strength; and it is styled in tune with the latest fashion trends.

The material is marketed in 40-yd. rolls, 50 to 52 in. wide, and about 0.012 in. thick. Cord-embossed, it sells for about $1.40 a yd. in quantity lots. According to the manufacturer, garments made from this material will cost about half as much as those made from good quality woven fabric of comparable weight.

Silicone in the news

Five leading chemical companies have been licensed by Dow Corning Corp., Midland, Mich., to manufacture silicone emulsions for producing Syl-mer and Sylflex water- and stain-resistant finishes on textiles and leather.

The new licensees are American Cyanamid Co., Arkansas Chemical Co., Refined Products Co., Soluol Chemical Co., and Warwick Chemical Co. Under terms of the agreements, the firms may use Dow Corning's Sly-mer name and identifying trademark in association with their own individual silicone emulsions.

Labels on silicone. The problem of labeling silicone-treated bottles has been solved with the development of Glastack-9499, a resin-emulsion adhesive, according of Paisley Products, Inc., New York, N. Y., manufacturer of the bonding agent. Glastack-9499 is said to actually penetrate the silicone layer on any glass container to bond to the glass surface underneath.

Cellulosic sheet up

Price increases ranging from 8 to 13% over current rates for cellulosic Kodapak sheeting has been announced by Eastman Kodak Co., Rochester, N. Y. The increases will apply to cellulose triacetate, cellulose acetate butyrate, and cellulose acetate sheet products.

The new prices, however, will be subject to large-order processing and handling savings on orders for 2500 lb. and over. Such savings will range from 3 to 5 percent. This is said to be the first price advance since 1952 for most types of Eastman's line of cellulosic sheeting.

Epoxy flexibilizer

An epoxy resin flexibilizer that becomes a permanent part of the resin, reduces resin viscosity, extends the resin's pot life, and improves its heat aging characteristics has been announced by Irvington Chemical Div., Minnesota Mining & Mfg. Co., Newark, N. J.

Called Cardolite NC 513, the flexibilizer is a clear, amber liquid resin that has epoxy groups in its chemical structure. It can be used with the same curing systems that are commonly used with epoxy resins. The working life of the mixed resin is said to be extended about 80% and the cure time to be unchanged from that of the unflexibilized resin.

The new flexibilizer is expected to find application in encapsulating electrical components and in electrical potting compounds, tooling resin applications, plastic forming molds, epoxy resin adhesives, patching and splining com-

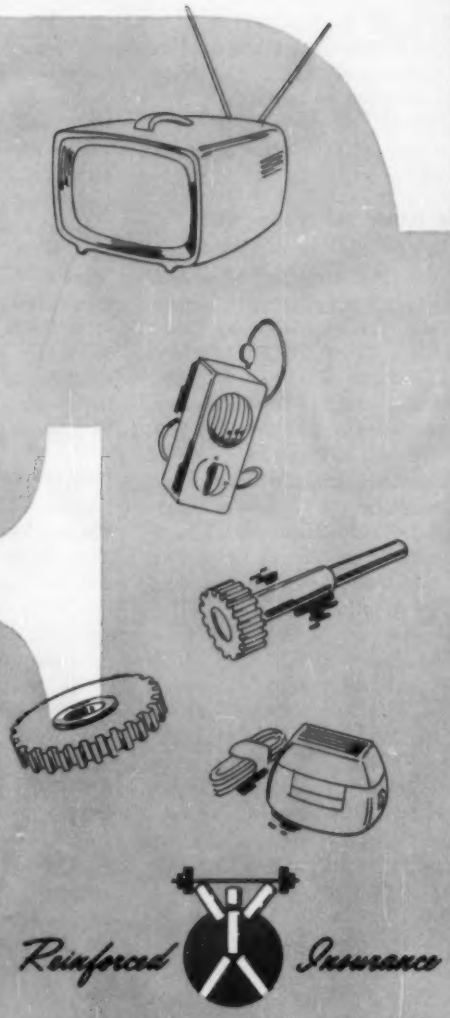
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New name for Tape #66

Rajah is the new tradename for the polyethylene/cellophane transparent tape, formerly known as Tape #66, produced by General Tape Corp., St. Paul, Minn. (See MODERN PLASTICS 34, 268, November 1956.) The company also announces that the tape has been altered in its make-up so as to include a greater amount of polyethylene (60%) and a lesser amount of cellophane (40%), said to result in greater resistance to normal atmospheric changes and improved dimensional stability.

A survey conducted by the firm indicated that Rajah tape compares favorably in the industrial market with regular types of cellophane tape from both cost and physical standpoints. It also indicated that in many cases the tape product has unexpectedly served as an adequate replacement for the more costly acetate film and acetate fiber tapes.

Rajah tape is available only in the 2592-in. length commercial size rolls, in widths of ⅜, ½, ¾ and 1 inch.

Irradiated polyethylene for electronic parts

By switching from polystyrene to irradiated polyethylene for the production of high-frequency vacuum tube voltmeter probe tips, Hewlett-Packard Co., West Coast electronics firm, has solved the problem of cracking at low temperatures resulting from different rates of expansion of the imbedded components. Such low-temperature stress cracking exposed the internal parts to moisture and was the major limitation of the polystyrene material. While conventional polyethylene overcomes the low-temperature cracking problem, its tendency to flow at high temperatures restricted its use under high ambient conditions and in applications where the probe tips are soldered directly into the electronic circuits under test.

Bombarding polyethylene probe tips with high-speed electrons from an 8 million-v. linear electron accelerator at Applied Radiation Corp., Walnut Creek, Calif., increased high-temperature resistance to about 250° F., with little effect upon the resistance to low-temperature cracking.

New former

Southern Plastic Products Co., Riviera Beach, Fla., has recently been organized to offer vacuum and low-pressure molding. The firm intends to specialize in package components, point-of-sale displays, and custom molding.

Business will be conducted under the general managership of Tom Nuttall, Jr.

Teflon tape for magnet wire

Wire covered with Teflon by a new process known as "Fused-Film Wire" may revolutionize the magnet wire industry, according to the producer, Adam Consolidated Industries, Inc. The process converts Teflon tape into a thin, concentric filmed insulation 0.002 in. thick. Until this development, the thinnest insulation for such purpose had three times this thickness and was not only too heavy for magnet wire, but mechanically inadequate at high temperature, according to company officials. Despite its reduced size, the new insulation has dielectric strength and scrape resistance 200% greater than comparable insulation, according to Harold Leitman, president of Adam Consolidated.

The unfused tape, furnished by Minnesota Mining & Mfg., Co., is fused by the new process into a sort of jacket for the wire—it is not fused to the copper but is a continuous coating without seams or joints. So far, it has been used in 2-, 3-, and 4-mil walls—it can go up to 10. It can be used for covering nearly all types and shapes of wire, including square. The price will be the same as competitive wire.

Tests have indicated that it will not oxidize at 600° F. for 200 hr., which is much higher than conventional insulation; that when heat-aged at 600° F. for 100 hr., it will withstand 4000 v. compared to a conventional insulation that reached 500 v.; that it will not break or abraid at twisted portions; that it is not subject to pinholes. And Teflon, of course, is impervious to fungus, chemicals, and water.

About $500 million worth of magnet wire was sold in 1956 and the FF Wire is after that market. The new process will be a great aid to miniaturization since it will reduce the amount of supplementary insulation now required in motor winding. It will be applicable for use in motors, generators, transformers, solenoids, computors, telephone cables, aircraft, missiles, vacuum cleaners, and hundreds of other uses in the electrical and electronic fields. Westinghouse has used about all that was available up to now in airborne equipment.

Adam Consolidated was formed from the old Adam Hat Corp. The FF Wire will be produced by Inso Products, Ltd., newly formed subsidiary of Adam Consolidated, and will use the Gemex plant of the parent company in Union. N. J. The process was developed by Charles Nixon, vice president of Inso Products, Ltd.

To set tests

A subcommittee of hardboard, fiberboard, and decorative plastics laminate manufacturers has been named by the National Electrical Manufacturers Association under the Decorative Laminate Advisory Technical Committee. Its task will be to establish a set of test procedures for the manufacture of hardboard and fiberboard core materials used in plastics laminating. These test

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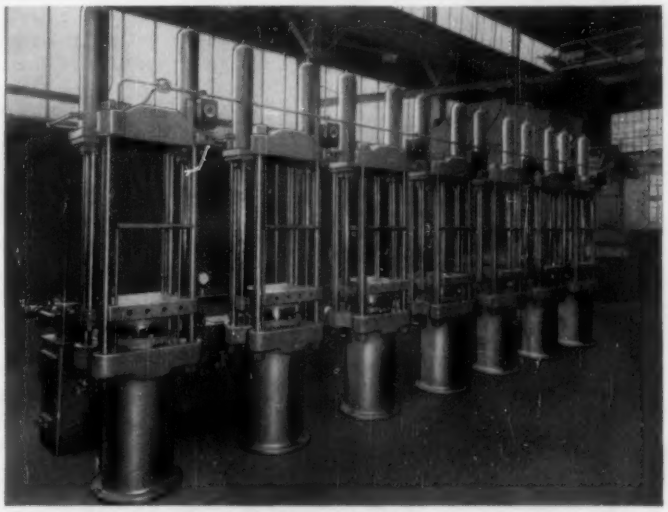
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procedures will cover test methods, sample sizes, testing conditions, and expression of results.

T. Walter Noble, technical director of Decar Plastic Corp., is chairman. Other members of the committee are Fred Seuffert, Hal Thomas, and R. C. McDevitt (representing the plastics laminate manufacturers); representing the hardboard and fiberboard manufacturers are John Caresio, D. Haile, and W. C. Walling.

A similar NEMA committee, the Decorative Laminate Advisory Technical Committee, was highly successful some time ago in establishing minimum standards for decorative plastics laminates and hardboard core type laminates when these products were first introduced into the furniture industry.

Perspex down

Reductions up to 20% in the prices for Perspex first quality cast methacrylate sheets have been announced by J. B. Henriques, Inc., 521 Fifth Ave., New York, N. Y., exclusive distributor in the United States for the Plastics Div. of Imperial Chemical Industries Ltd., England.

Large stocks of clear material, available for immediate shipment, are maintained in a warehouse in New York City, and a wide range of colors may be ordered for shipment from the factory.

Photo-sensitive plastic printing plate

Substantial progress toward the development of a pre-sensitized, lightweight, flexible plastic printing plate of potentially wide use in the letterpress field has been announced by Du Pont's Photo Products Dept.

After exposure through a high contrast photographic negative and washing in a simple water solution, the printing plate is ready for use. The image is formed by a chemical change in the light-sensitive plastic during the exposure. Unexposed areas are then "washed out," leaving a relief of up to 0.040 inch.

The company expects field testing of these new plates to begin this year and to have commercial quantities available during 1959.

New materials supplier

Complete facilities for dry blending and coloring of all thermoplastic molding materials are being offered by newly formed Lamb Plastics, Lambertville, N. J. The company also reprocesses polyvinyl chloride to produce a material claimed to be as close to virgin p.v.c. as is possible. Lamb's own laboratory tests are cited to support the claim that its reprocessed p.v.c. shows less degradation, greater uniformity, and offers a better and faster rate of extrusion than similar reclaimed polyvinyl chloride.

Allan Levin is president; B. F. Smith, director of sales; Eugene Snavely, works manager; and Jerome Szpila, chief chemist.

Contract R & D offered

A new laboratory which offers research and development services on a contract basis has been established in Madison, Wis., by Trionics Corp. Special fields in which the laboratory will be active include plastics, coatings and surface treatments, materials for electronic components, high-strength low-weight materials, packaging materials, corrosion inhibition, high- and low-temperature-resistant materials, and others.

Hose for cleaning pools

Aluminum-reinforced vinyl 1½-in.-I.D. hose for use in swimming pool vacuum cleaners has been developed by Acme Rubber Mfg. Co., Trenton, N. J. Designated Aqua-Vac, the hose is laminated from a spiral winding of specially formulated plasticized p.v.c. (Bakelite) and aluminum wire (Alcoa). After fusing, the hose has a smooth inside and a corrugated outside surface.

Aqua-Vac is claimed to be 50% lighter than the rubber-textile sheeting-steel wire hose it replaces, to cost about 25% less (at distributor level), and to have about the same service life.

Other applications for which the hose is currently used include: 1) industrial vacuum cleaning; 2) seeder chute in plows; 3) in certain phases of its nylon operation by Du Pont; and 4) boarding and trimming operations in the textile industry. The hose is also being evaluated by York Air Conditioner Div., Borg-Warner Corp., as a conduit.

Smaller-diameter hose similarly constructed for home vacuum cleaners will be available from Acme shortly.

Plastisol spray coating

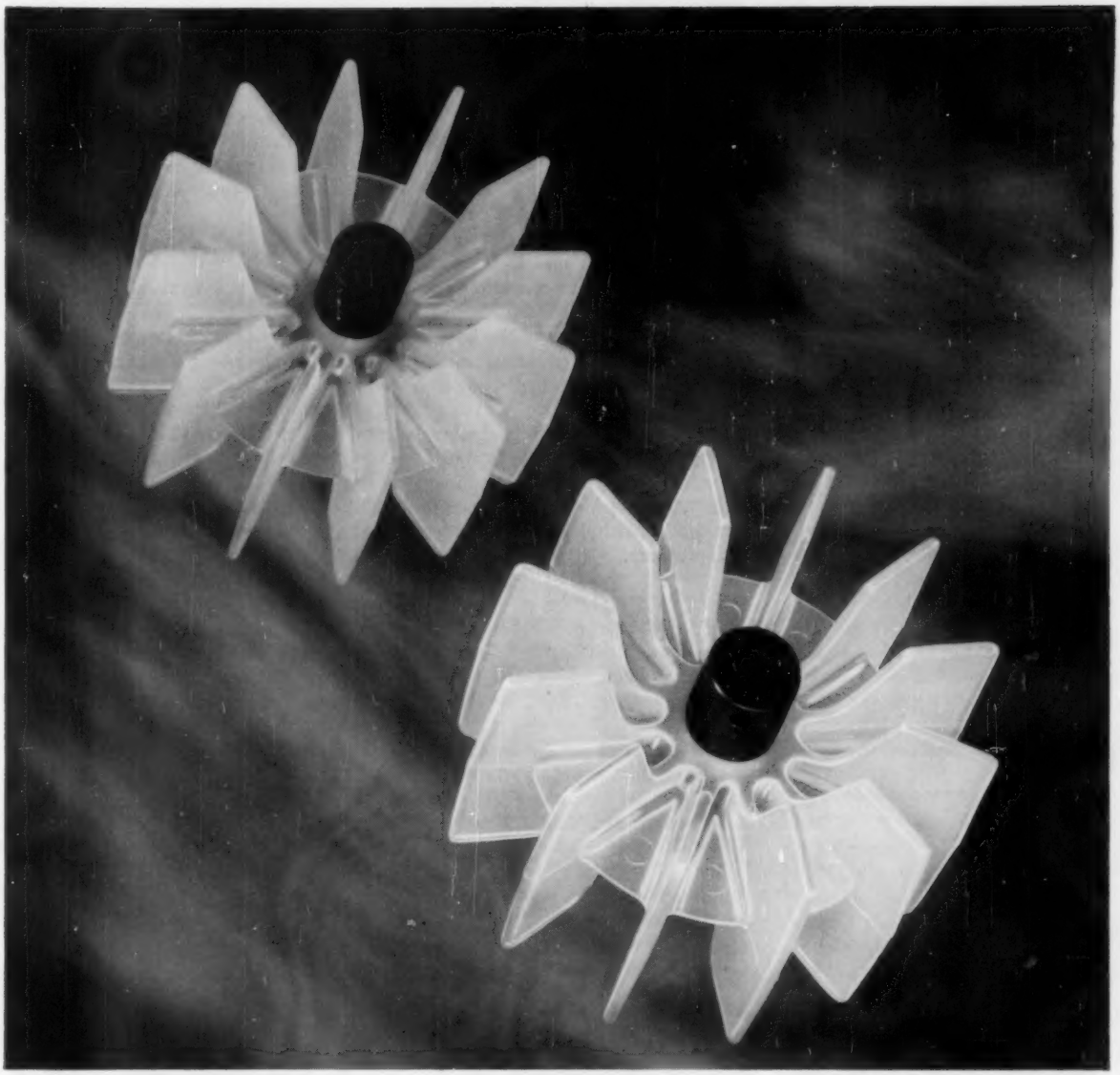
A polyvinyl chloride plastisol that can be sprayed on cold vertical metal surfaces as a protection against chemical corrosion has been announced by Quelcor, Inc., Chester, Pa. Tradenamed Quel-Spray, the plastisol is said to be particularly useful in applying chemically resistant coatings to metal parts and structures which cannot be conveniently dip coated.

According to the company, Quel-Spray requires no thinner, can be left in the gun overnight, and loses no thickness from wet to dry film when cured at approximately 350° F.

Installs heat-sealing equipment

The growing importance of vinyl in the automotive field is pointed up by the installation of electronic heat-sealing equipment at Mitchell-Bentley Corp.'s Owosso Manufacturing Div., Cwosso, Mich. The equipment, manufactured by Radio Receptor Co., Brooklyn, N. Y., will be used to fabricate interior door panels and seats for the automotive "Big 3." The units are 50-kw., 100-ton hydraulic press Thermatrons.

The installation can handle four seats, backs, door or side panels simultaneously, depending upon the arrangement of the dies. Included is a unit which can quilt and weld vinyl sheet and foam



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Styrex 767 proves look-alikes don't perform alike

Performance-testing these two cooling fans for movie projectors quickly reveals that the right one is made of Styrex® 767, a new Dow copolymer of styrene acrylonitrile. Fact is, the manufacturer of this part found no other material having the quality, performance, and molding ease of thermoplastic Styrex.

In operation, its high tensile strength minimized creep and cold flow. In production, faster cycling and better moldability resulted in marked economies.

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and die-cut it to desired shape and size in one operation. The same operation can bond any number of varicolored sections. Some manufacturers have their insignia embossed into the plastic at the same time.

Plastic JA firm scores

A trophy for producing the best annual report of any of the 46 JA companies in Minneapolis, Minn., has been awarded to Plasco, a Junior Achievement company sponsored by Archer-Daniels-Midland Co.

Plasco last fall sold 200 shares of stock at 50¢ each to provide capital for its operations. The company manufactured and marketed an all-plastic lint remover. After a successful year, the firm declared a dividend, retired its stock, and dissolved.

Scholarship award made

The 1957 Charles P. Gulick Scholarship has been awarded to Charles Arlin Zebeau, son of Ernest Zebeau, production foreman of Nopco Chemical Co.'s Cedartown, Ga., plant. The scholarship, awarded annually to a son or daughter of a Nopco employee, has a value of $750 per year.

Mr. Zebeau graduated from Cedartown High School last month and plans to attend the University of Georgia.

Strong, lightweight p.v.c. tubing

Nylon-reinforced modified p.v.c. flexible tubing has been developed by Airconductors, 1458 W. Compton Blvd., Compton, Calif. Designated Aircon 10-1010, the tubing is designed for use as ducting to convey liquids, gases, and air under pressure; as plumbing to transmit corrosive acids and alkalies; and as flex conduit for electrical and electronic equipment.

Raw materials for the tubing are compounded by Irvington Varnish Div., Minnesota Mining & Mfg. Co., under strict control and to specifications of Airconductors. When received by Airconductors, the materials are further processed and laminated together in a single operation on specially developed machines.

Temperature range of the hose, depending upon pressure and contaminants, is from —65 to 200° F.

Other 10- series tubing similar in appearance to 10-1010, is made for such applications as handling red fuming nitric acid or unsymmetrical dimethyl hydrazine under pressure.

Softest vinyl yet

A vinyl fabric consisting of a p.v.c. coating on a napped back fabric has been added to its line by Textileather Div., The General Tire & Rubber Co., Toledo, Ohio. Described by the company as the softest vinyl fabric ever manufactured commercially, it has been named Tolex Glovette. The material, produced with a leather-like texture, is available in a range of colors. It is designed for use as furniture upholstery and is said to be especially suited for deep spring pieces.

More products in squeeze containers

Krim-Ko Corp., Chicago, Ill., is marketing a true chocolate fudge sauce, "Topps," in a squeeze-to-use Bracon polyethylene tube, manufactured by Bradley Container Corp., a subsidiary of American Can Co., Maynard, Mass. The container is made of pure white polyethylene, overprinted in an attractive design of red and brown.

Manufacturers of resin hardeners are also starting to package their products in these leakproof no-roll containers. The package has been found particularly suitable for dispensing a chemical solution which is used to set up a catalytic action for the resins used in splicing wire cables.

To apply the liquid chemical to the mixture, the technician simply squeezes the soft polyethylene walls of the container to emit just the correct amount. If the contents of the package have a tendency to settle, harden, or emulsify, the package may be worked by moderate finger-pressure on the tube prior to cap removal.

Service for smaller firms

Marketing and financial services devoted exclusively to the needs of the plastics industry are being offered by a newly organized firm, J. B. Durra & Co., 77 W. Washington St., Chicago, Ill. The company will function in market development, product development, financial assistance in equity or debt financing, and brokerage service in the acquisition or sale of plastics companies. Its services are aimed at small to medium-size companies without market and product research and development facilities.

Joseph B. Durra, formerly advertising and sales promotion manager of Ciba Co.'s Plastics Div., heads the new organization.

The name's the thing

PyroPanl is the name which was chosen from entries submitted by Corrulux Distributor sales personnel throughout the United States for the new fire-retardant structural reinforced plastics panel developed by the Corrulux Div. of L.O.F. Glass Fibers Co., Houston, Texas.

The new material, which carries the Underwriters Label and Factory Mutual Approval, is said to retain all the properties of standard Corrulux. The fire-resistant panels have high strength and are shatterproof and durable but still provide good light transmission.

PyroPanl is available in industrial colors, flat sheets, and many corrugations.

Methacrylate hobbing sheets

Specially formulated methacrylate sheets and blocks up to 10 in. thick for use in hobbing or pressure forming of decorative second surfaces are now manufactured and distributed by Cadillac Plastic & Chemical Co., Detroit, Mich. The material is claimed to be softer, less brittle, and to flow


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more readily than regular methacrylate sheets. Standard sheets are clear, 24 by 24 in., with planed surfaces. Colors are available on special order.

The hobbing process is used to make appearance models, engineering prototypes, or molder's preproduction samples of internally carved parts, such as crests, lenses, or dials, which will later be injection molded.

Packaging adhesive

Polyvinyl acetate resin emulsion adhesive E2131, developed by Paisley Products, Inc., Chicago, Ill., is said to be completely dextrine-compatible and interchangeable with any borated alkaline dextrine adhesive without packaging machine shutdowns to clean the glue box.

The new product is white, 2100 cp. in viscosity, non-foaming, and claimed not to build up.

Plastics printing equipment

The Alexander J. Shannon Co. has entered into the manufacture of a line of machinery for printing and processing plastic film and sheeting. This includes machinery and equipment for laminating, embossing and printing vinyl film, as well as rotogravure printing presses for vinyl and polyethylene. In addition, the company will manufacture such accessory equipment as high-pressure steam drums, printing roll blanks, etc.

Manufacturing headquarters are at Fonda, N. Y., and executive offices at 150 Broadway, New York, N. Y.

Proposed standards for cellular plastics

A relatively new division of The Society of the Plastics Industry, Inc., The Cellular Plastics Div., under the chairmanship of Paul Roach, executive engineer, U. S. Rubber Co., Mishawaka, Ind., has had three line committees and subcommittees at work on proposed standards and test methods for three main foam or cellular plastics groups.

The first is a tentative specification and set of test methods for foam made from polyvinyl chloride or vinyl copolymers. The second is a set of proposed standard methods for the chemical analysis of urethane foam raw materials. Both these proposed or tentative standards are now complete and are available for study from the offices of S.P.I., 250 Park Ave., New York City.

A third set of specifications, these for raw materials for all rigid foams, is currently under development and will be available shortly through S.P.I. offices.

Finish for methacrylate

An outdoor finish for methacrylates (S-135 for spray application and SV-136 as a screening ink) has been released by Logo, Inc., Chicago, Ill. The color systems incorporated in these materials are said to be light-stable, to have good weatherability, and high resistance to humidity, grease, and detergents.

Epoxy for car repair

Paste-type epoxy resin for use in automotive repair is offered by Ren Plastics, Inc., Lansing, Mich., as a replacement for hard solder. The company states that the epoxy holds fast to clean surfaces of any other plastics, metal, wood, or glass; it is dimensionally and chemically stable; it resists acids, alkalies, greases, salt air, and common solvents; it will not rot, rust, corrode, or dry out; and it is unaffected by heat or cold.

The paste is applied to the part to be repaired like putty and is said to harden like metal. Hardening time can be controlled from normal 2 to 4 hr. at room temperature (75° F.) to 1 to 5 min. by use of heat.

For auto body dents, only a minimum of bumping is necessary. In the case of rot in confined areas of the auto body, holes can be filled with steel wool. To obtain backing over large holes, hardware cloth or light-gage sheet metal is spot-welded in position.

Fluorocarbon hose available

After two years of thorough testing, Resistoflex Corp., Roseland, N. J., has released its Fluoroflex-T R700 hose and R25800 hose assemblies in production quantities for unrestricted use. At present, only -4 and -6 sizes are available; others will be released in the near future. The hose and hose essembly are designed to meet the need of the aircraft industry for a dependable lightweight, high-temperature, high-pressure hose for the new 3000 p.s.i. hydraulic system.

Produced from Teflon by carefully controlled fabricating techniques, the hose is said to be chemically inert to all natural and synthetic hydraulic fluids and completely unaffected by even the strongest acids, alkalies, and oxidizing agents. It has been conservatively rated for a useful temperature range of from −65 to +400° F.

Packaging research grows

Formation of the first research and marketing agency devoted exclusively to the $12 billion packaging industry was announced at the closing session of the Package Research Conference held in New York City. Called Package Research Institute, Inc., the agency is an affiliate of Lippincott & Margulies, New York industrial designers and sponsors of the first annual Package Research Conference.

Package Research Institute has begun operation at 430 Park Ave. It will also carry on basic studies in perceptual research. The Marketing Dept. plans to open for business in the fall.

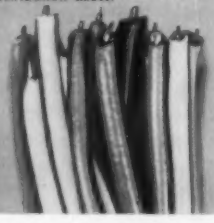
Custom welding offered

Manufacturers and jobbing concerns who use or make tools, dies, or molds can now avail themselves of a custom welding service offered by Precision Tool & Die Welding Co., Clifton, N. J. According to the firm, tools, dies, molds, hobs, etc., formerly discarded or repaired at a high cost,



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Polyethylene 12203 and 12253 for primary insulation. Polyethylene 14202 for jacketing in jacketed Thermoplastic-insulated, Thermoplastic-sheathed Telephone Cables.





OPALON 1006 for primary insulation. OPALON 72217 for jacketing in Inside Telephone Wiring Cable.

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can now be returned to production by a faster, more economical and practical manner with the proper application of welding. Precision Tool also states that it will correct machining errors, add material for design changes, and reclaim worn dies, using the same analysis as the parent metal.

Molded jars from Agile

Polyethylene jars with 3/16-in. wall thickness are now molded by American Agile Corp., Maple Heights (Cleveland), Ohio, from both branched and linear materials. Available in 1-qt., 2-qt., and 1-gal. capacities, the jars are designed with interlocking covers, claimed to make them 100% leakproof.

The new containers replace Agile jars of the same capacities which were formerly produced by a welding process and equipped with friction fitting covers.

Release agent

A special-formula release agent, Sonite Seal-Release, developed primarily for separating epoxy or other resin castings from plaster, gypsum, cement, wood, metal, and plastics, has been announced by Smooth-On Mfg. Co., 572 Communipaw Ave., Jersey City, N. J. It is in the form of a soft gel and may be applied by rubbing, brushing, or spraying. For deep penetration of porous molds, or for spraying, Sonite Seal-Release is thinned with equal parts of either naphtha or gasoline.

Aids inspection and assembly

Pressure-sensitive labels which can be written on with pen, pencil, ball point, or typewriter are manufactured by W. H. Brady Co., Milwaukee, Wis., for use in recording inspection, assembly, job status, calibration, and maintenance information. The write-on labels come mounted on 9 in. long dispenser cards that function as portable boards, enabling the user to write and apply the label on the spot.

The labels are stocked in vinyl-cloth and 0.003-in. aluminum foil. Eighteen types are carried in stock. Stock legends like "Rejected," "Accepted," "Hold," etc. are furnished on vinyl-cloth. Blank labels are stocked in vinyl-cloth and aluminum foil in sizes ranging from ¼ by 1½ to 1½ by 1½ inches.

Non-irritant cleaner

Workers in the plastics tooling industry can now avoid skin rashes caused by alcohol and acetone-type solvents by using a hand cleaning compound called Epoxy Remover. The product, produced by United States Gypsum Co., Chicago, Ill., and available from Plaster Supply House, Chicago, Ill., is similar to cold cream in consistency, and is pink in color. It contains lanolin but no strong caustics or scouring abrasives.

The compound is worked into the adherent substances on the hands until they are loosened and absorbed into the cream, and then rinsed off with water.

Flat-laying laminations

A modified polyvinyl acetate resin-based adhesive for producing flat-laying laminations has been developed by Polymer Industries, Springdale, Conn., and is available in production quantities. Designated Polybond C41, the laminant can be applied in a thin glue line and is said to bond dependably at high rates. C41 is also reported to be water resistant and free of odor.

Dip coat protects metal

Strip-off plastisol dip coating for the protection of metal parts has been formulated by the Chemical Processing Div. of Auburn Button Works, Inc., Auburn, N. Y. The company states that the coating can be applied by unskilled labor by simply heating the parts and dipping them in the plastisol.

The coating is primarily intended to protect metal parts that are subject to rust, corrosion, dirt, or damage while in storage or transport, particularly for precision instruments and parts having sharp edges. It also has been good thermal and electrical insulating properties.

Plasticizer news

Plasticizer doubles as intermediate. Developed by the reaction of glycerine and propylene oxide, a new plasticizer and chemical intermediate has been announced by The Dow Chemical Co., Midland, Mich.

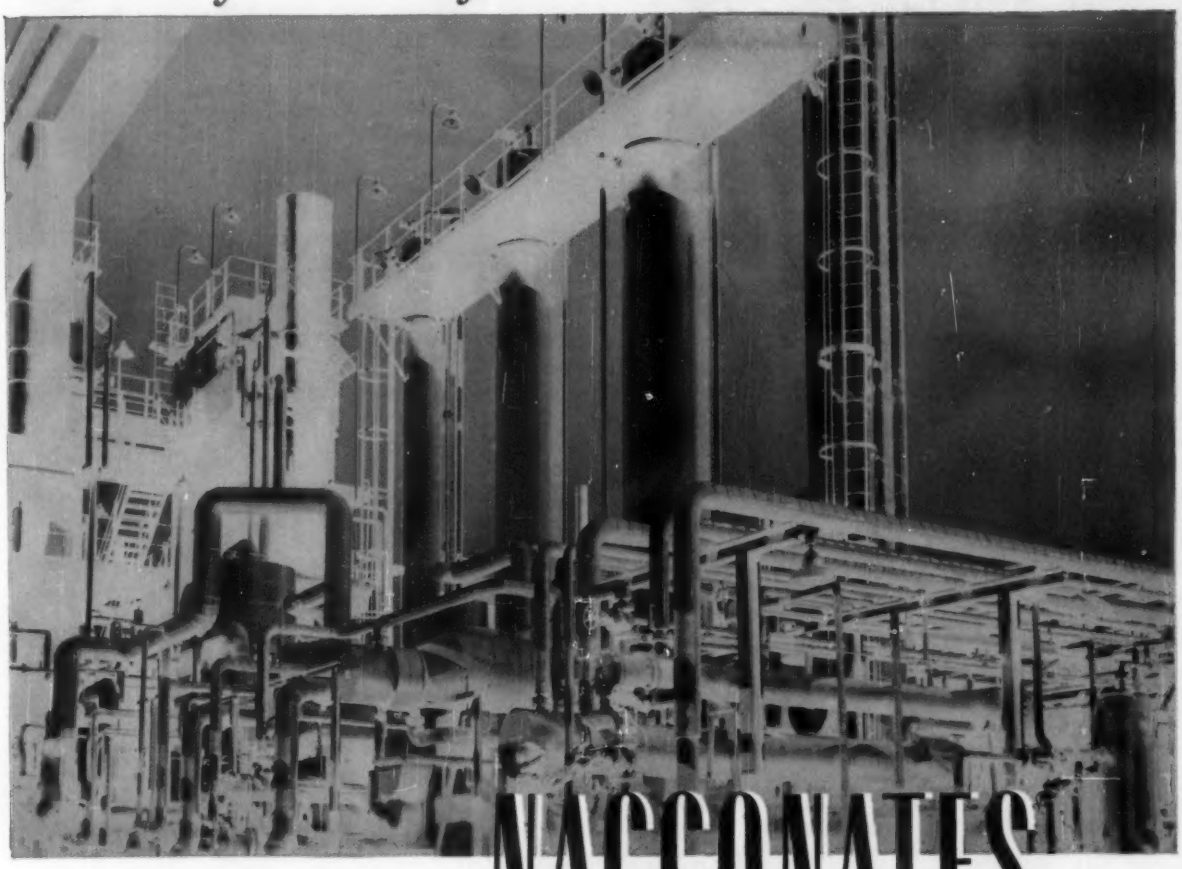
Designated Hyprin GP25, the chemical is being used as a plasticizer for some cellulosic products and shows promise in the paper, cellophane, and other cellulosic fields. It is also said to offer possibilities as a plasticizer for other materials, such as glues, starches, dextrins, cork products, and phenol-formaldehyde resins. The company claims that Hyprin GP25 has less effect on the tensile strength of cellulosic products than glycerine or propylene glycol; it is less volatile than glycerine and as a result has greater permanence on aging; and it is less hygroscopic than glycerine.

Because of its similarity to glycerine, Hyprin GP25 offers possibilities in the manufacture of alkyd resins and polyesters. It can be esterified with dibasic acids and anhydrides such as phthalic anhydride to produce products of increased flexibility. Where a non-drying alkyd is required, this form of hydroxypropylglycerine may be used to obtain a product with a high molecular weight and increased fluidity.

Among other uses being studied by Dow are those where glycerine, glycols, or sorbitol are now in use, especially where decreased volatility and/or decreased hygroscopicity are desired.

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- ☐ Interested in Literature only.
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G-14

The Plastiscope

and Cottman Ave., Philadelphia, Pa., is offering two bulletins describing plasticizers made from isosebacic acid. The new esters are similar in physical properties and performance to the corresponding normal sebacates and in most applications can be substituted for the latter materials with considerable reduction in cost. Full-scale production will commence in October.

The firm's Kesscoflex DOIS is di-2-ethylhexyl isosebacate, a monomeric ester-type plasticizer. An average composition is di-2-ethylhexyl ethyl Suberate 76%; di-2-ethylhexyl diethyl adipate 16%; and di-2-ethylhexyl sebacate 8%. DOIS has a moderately branched structure compared with the straight linear arrangement in normal sebacate esters but is claimed to have almost the same properties such as low water solubility, resin compatibility, low-temperature properties, and other physical characteristics typical of dioctyl sebacate but at considerably lower cost. It is suggested for nearly all plastics which use plasticizers—vinyl chloride, butyral, cellulose acetate, and others.

Kesscoflex DBIS is di-n-butyl isosebacate, a monomeric, ester-type plasticizer suggested for heat and light stability in butyral; low-temperature flexibility in synthetic rubbers; high gloss and clarity in lacquers; high efficiency in vinyls; and normal plasticization for butyrate, polystyrene, methacrylate, and ethyl cellulose.

Cabot to discontinue plasticizer sales. Godfrey L. Cabot, Inc., Boston, Mass., has discontinued sales of its present line of Cabflex plasticizers. Arrangements have been made with Deecy Products, 120 Potter St., Cambridge, Mass., to supply any future needs for Cabflex plasticizers.

Celanese adds epoxies. Two epoxy plasticizers, Celluflex 21 and Celluflex 23, have been introduced by Celanese Corp. of America. Produced at the Point Pleasant, W. Va., plant, they are said to impart good low-temperature performance and color stability to p.v.c., cellulose nitrate, and neoprene with reduced plasticizer loss due to volatility. The new plasticizers are also claimed to provide low and stable viscosity for plastisols. End product applications include vinyl film and sheeting, coated fabrics, extruded tubing and hose, and slush and injection molded items. The materials also serve in synthetic rubber formulations.

Celluflex 21 is reportedly superior in providing low-temperature performance to Celluflex 23, which may be considered an intermediate low-temperature plasticizer, about the equivalent of DOP in that respect. It contains more epoxide groups than Celluflex 21 and is suggested as a possible replacement for oxidized oil. Quantity prices for Celluflex 21 and Celluflex 23 are 40¢ and 37¢ per lb., respectively.

Pipe notes

Lined pipe available. Teflon-lined pipe is available from Halocarbon Div., Haveg Industries, Inc., Wilmington, Del. Sizes offered are 1-, 1½-, 2-, and 4-in. diameter in lengths of 2, 5, and 10 feet. Haveg also offers Teflon in thin- and heavy-walled tubing, rod, sheet, and coated wire.

Because of its high cost, this pipe is suggested only for those applications where corrosion and maintenance problems are severe and can be solved through the non-contamination and non-adhesion characteristics of Teflon.

Geon in Texas. More than 25,000 ft. of high-impact rigid polyvinyl chloride pipe, made from B. F. Goodrich Chemical Co.'s Geon resin, is now in use in the park and recreation system of San Antonio, Texas. The city made its first p.v.c. pipe installation last year in Maverick Park, a recreation area which covers about 3½ acres. Since then, four parks and two sports centers have been equipped with similar watering systems, and plans call for 12 more parks to be so outfitted this year.

The pipe was extruded from Geon 8700A by The Mott Co., Houston. Fittings were manufactured by Sloane Mfg. Co., Sun Valley, Calif. The solvent used was p.v.c. weld-on #10-F, blended by Industrial Polychemical Service, Gardena, Calif.

For plumbing use. A line of plastics pipe for commercial and residential plumbing applications has been announced by Pyramid Industries, Inc., Erie, Pa., under the name of Super Pi-Mar. The new pipe is fabricated from high density (linear) and conventional (branched) polyethylene produced by the Chemical Div. of Koppers Co., Inc.

According to the manufacturer, by taking advantage of the optimum tensile strength characteristics of each of the materials, pipe series meeting the specifications for working pressures at 75, 100, and 125 lb. can be produced with minimum wall thickness and an equivalent saving in weight over conventional tubing.

The new series of coilable pipe is said to be stronger than conventional polyethylene tubing and can be securely joined at all unions with special clamps. It carries the National Sanitation Foundation Testing Laboratory Seal of Approval.

H-D polyethylene for plumbing. American Vulcathene, Div. of The Nalge Co., Inc., 625 S. Goodman St., Rochester, N. Y., is now offering its Universal series of wastes and traps in high-density polyethylene. These plumbing accessories are said to have high chemical resistance and to be capable of handling boiling water continuously.

Nebraska producer grows: Western Plastics Corp., Hastings, Neb., producer of polyethylene pipe, announces that it has more than doubled its production area. The firm makes Klearcor pipe,

constructed with a clear, unpigmented virgin polyethylene core and an outer jacket of compounded black polyethylene. (See MODERN PLASTICS 34, 203, February 1957.)

The company also announces a price reduction on its entire line.

Largest union to widen scope. A 3-in. screwed p.v.c. pipe union, said to be the first of this size, has been introduced by Walworth Co., 60 E. 42nd St., New York, N. Y., and is expected to increase p.v.c pipe application possibilities which have only been limited by the availability of smaller unions. Specially designed surfaces in the joints of the three-part union are claimed to provide a tight seal.

Weighing about 1½ lb., the 3-in. union is said to be easily handled and installed. A knurled ring is provided for better grip. The union is available with threaded or solvent-weld socket-type ends in either high- or normal-impact p.v.c.

Expansion

Monsanto Chemical Co.'s Plastics Div. announces that its new multi-million dollar facilities at Trenton, N. J., to produce Saflex polyvinyl butyral film, used as the plastic interlayer in the manufacture of safety glass, are now in operation. The new plant more than doubles Monsanto's capacity to produce Saflex. Previously, the company's entire Saflex production capacity was located at the division's plant in Springfield, Mass.

Saflex is made from Butvar polyvinyl butyral resin supplied by **Shawinigan Resins Corp.**, an associate company jointly owned by Monsanto and **Shawinigan Chemicals, Ltd. (Canada).** A new Shawinigan Resins plant to produce the base resin is nearing completion at the Trenton site.

B. F. Goodrich Industrial Products Co. announces plans for the construction of a specialized plant in Akron, Ohio, at a cost of approximately $2.5 million for the manufacture of adhesives. Ground will be broken for the new building late this summer

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SHEET, ROD, TUBE CATALOG. Extensive catalog gives dimensions, specifications, colors and prices of company's line of extruded, cast, and molded sheet, rod, and tube stocks. Cadillac Plastic & Chemical Co. (G-701)

HEAT-SEALABLE TAPE. Bulletin describes thermoplastic heat-sealable tape made of polyester resin, and suitable for bonding plastic films and non-plastic materials. Said to have excellent dielectric strength over a wide temperature range. G. T. Schjeldahl Co. (G-702)

INJECTION PRESS. Folder contains specifications of 2¾ oz. injection press. Also illustrates compression presses manufactured by this company. Clifton Hydraulic Press Co. (G-703)

PRINTING ON PLASTICS. Illustrated literature describes hand-operated printing presses for printing on curved, uneven or flat surfaces of plastics or other materials such as metal, glass, wood. International Marking Machine Co. (G-704)

VINYL PLACTICIZER. Technical data bulletin gives information on all-polymeric permanent plasticizer for vinyl. Includes data on properties, compatibilities, compounding and applications. Harchem Division, Wallace & Tiernan, Inc. (G-705)

Any of the booklets described here, plus many others—forty-four in all—are available for the asking, without charge or obligation.

Just turn to the Manufacturers' Literature page in this issue (it's printed on heavy paper), circle the numbers corresponding to the booklets you want, fill in the reply postcard, and mail. No postage needed.

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The Plastiscope

and completion is scheduled for 1958.

The new facility will service the adhesives requirements of BFG and the demands of commercial customers. It will house production facilities and a development laboratory. About 100 persons will be employed.

BFG adhesives, which have hundreds of industrial uses, have replaced rivets in the fuselage, wings, and tail assembly of the supersonic B-58, the "Hustler," manufactured by **General Dynamics Corp.** Adhesives are used extensively in the aeronautical, automotive, building, packaging, appliance, radio, television, and other industries.

United States Plywood Corp. has opened a new research center at Brewster, N. Y. Designated the **Lawrence Ottinger Research Center** in honor of the firm's late founder, the new facility will incorporate chemistry, physics, structural, and testing laboratories.

Primary task of the center, according to the company, will be to seek new laminations or combinations of plastics, wood, metals, resins, paper, textiles, and other materials suitable for construction, decorative, or functional purposes.

Charles B. Hemming has been named director of the center. A new products development division of the center, headed by **Vernon F. Sears**, will maintain liaison between the center and U. S. Plywood's regional facilities.

Riegel Paper Corp. announces arrangements for the acquisition of the plant and equipment of the former **Amos Packaging Div.** of **Amos-Thompson Corp.** in Edinburg, Ind. The purchase is to be effected by the issuance of 34,000 shares of Riegel common stock.

The company plans to equip the plant to manufacture the broad range of packaging materials produced at its Milford, N. J., plant. It will be operated as the Edinburg plant of Riegel Paper Corp. All bag-making equipment now in the plant will be disposed of, as Riegel will not enter the bag-making field.

Allan Stone, formerly general manager of the Amos division, will continue as plant manager.

The Cryovac Co., Div. of W. R. Grace & Co., announces the construction of a $1 million addition which will double the manufacturing area of its plant at Simpsonville, S. C. The expansion is based on forecasts for the sale of Cryovac bags and film, which are said to indicate that by 1961 the Simpsonville plant will require twice the manufacturing space. The company decided to build now and add equipment as needed.

Plastic Age Co., San Fernando, Calif., has started construction on a new $1 million plant to be built on a 110-acre site near Saugus, Calif. The new facilities will consist of seven buildings.

The facilities are expected to more than double present production capacity and have been so planned that production may be increased 400% without shutting down any of the present production operations.

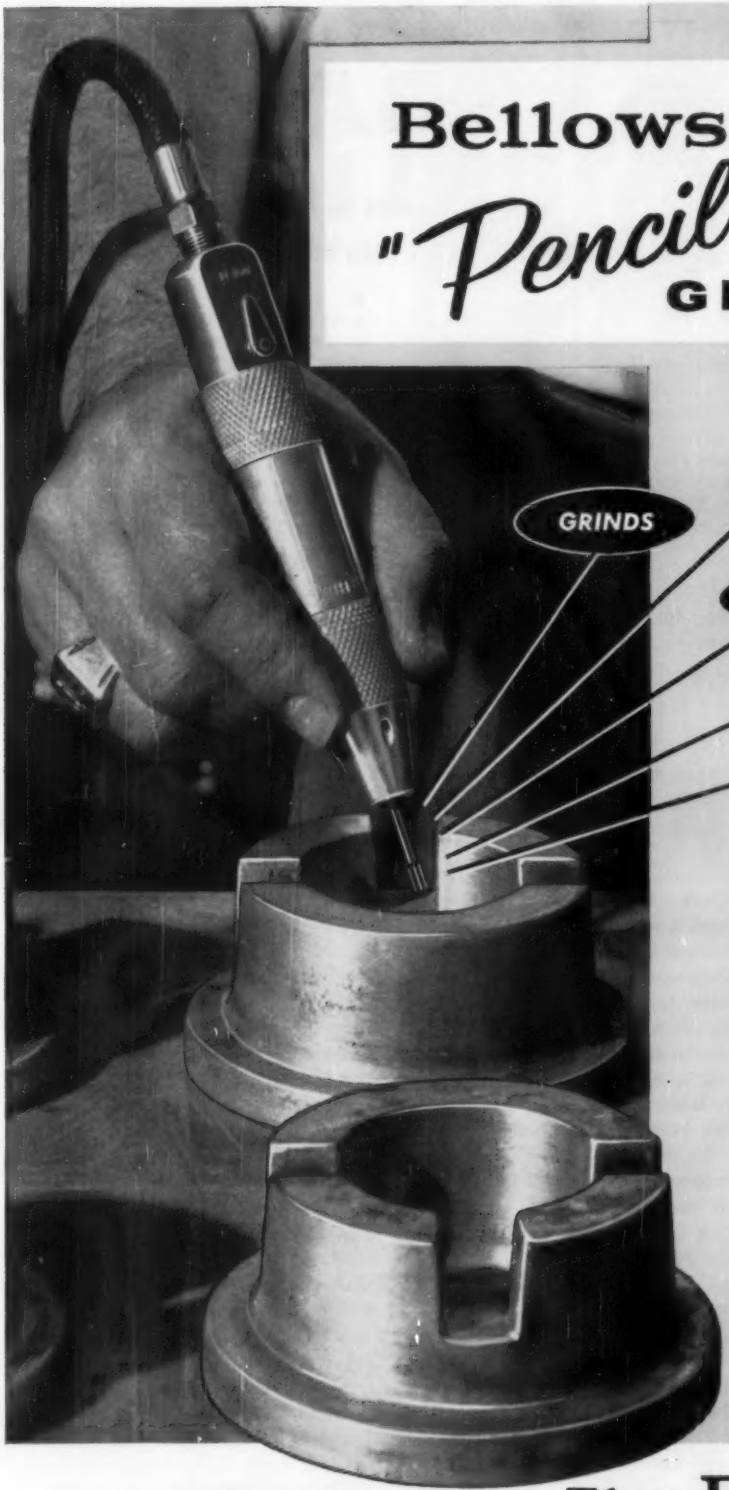
Both the Reinforced and Transparent Plastics Div. will be located on the new site.

Dow Corning Corp. is constructing a plant for manufacturing silicone consumer products at Greensboro, N. C. The new building will occupy about 35,000 sq. ft. on a 6-acre tract. The company also announces the establishment of the **Silicone Specialties Div.** as a separate operating unit.

The Dow Chemical Co. announces that two new plants at Riverside, Mo., and Ironton, Ohio, for the manufacture of Styrofoam expanded polystyrene foam doubles the company's production capacity for the product.

Delhi-Taylor Oil Corp.'s Chemical Div. has started operation of its new petrochemicals plant in Corpus Christi, Texas, according to an announcement by Harry W.

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The Plastiscope

Dudley, general sales manager. The $4 million plant includes a Udex extraction unit said to have a capacity of 45 million gal. per year. Initial production will include benzine, toluene, and xylene. Subsequent additions of other petrochemicals are under study.

Pittsburgh Coke & Chemical's Industrial Chemicals Div. announces start-up of new $3 million phthalic anhydride facilities on Neville Island in the Ohio River below Pittsburgh. Built and engineered by **The Lummus Co.**, New York, N. Y., the new plant doubles the company's phthalic anhydride capacity.

Northwest Plastics, Inc., St. Paul, Minn., has started construction on a new molding plant at Gastonia, N. C. The new facility, which will be operated by a subsidiary corporation, **Northwest Plastics of Carolina, Inc.**, will be directed by officers of the parent company.

The Gastonia plant, which will employ about 50 persons and is scheduled to start operations next month, will service electric and electronic component industries with intermediate plastic parts.

Twentieth Century Plastics Co. has moved from 2845 W. Irving Park Rd. to enlarged quarters at 4210 N. Sayre Ave., Chicago, Ill., and has increased its injection molding machines to seven.

Facilities for bright plating, hot stamping, spraying, finishing, and decorating are now also available. The new plant comprises an area of 10,000 sq. ft. and incorporates provision for 100% expansion.

Modiglass Fibers, Inc., formerly known as Modigliani Glass Fibers, Inc., has started construction on a new 40,000-sq. ft. plant on a 26.5 acre site at Bremen, Ohio. Products to be made at the new facility include fibrous glass surfacing mats, veils, structural mats, and decorative materials for the reinforced plastics field.

Chemical Process Co., Redwood City, Calif., has completed a plant expansion program which has tripled its production capacity for the manufacture of DION polyester resins and the new DION isophthalic resin.

The company, founded in 1938, also produces ion exchange resins and plywood adhesives.

Dake Corp. has started construction on a new plant at Grand Haven Township, Mich. The facility, providing 45,000 sq. ft. of shop space and 5600 ft. of office space, will be located on a 10-acre site. Its cost is expected to exceed $500,000.

Dake manufactures hydraulic, utility, and arbor presses.

Raybestos-Manhattan, Inc., is constructing a new laboratory at its plant in Stratford, Conn., for the development and testing of its line of Ray-Bond thermoplas-

tic and thermosetting adhesives, coatings, and sealers made by the firm's Adhesives Dept.

Ray-Bond adhesives, protective coatings, and sealers constitute a new line developed by Raybestos-Manhattan and offered for general industrial application last year.

Ryko Products, Inc., custom extruder, announces completion of its new plant set-up and start of production at its new location at 814 San Fernando Rd., Los Angeles, Calif. The new facility provides an area of 20,000 sq. ft., with 9,000 sq. ft. presently set up for general offices, production, and tool and die shop.

Deecy Products Co., 120 Potter St., Cambridge, Mass., has put into production, as a part of its expansion program, new facilities which increase plasticizer manufacturing capacity by 12 million lb. a year. The company also manufactures a line of vinyl stabilizers.

Tumb-L-Matic, Inc., supplier of tumbling equipment and processes, has moved from 4510 Bullard St., New York, N. Y., to its new plant in Stamford, Conn. The move is expected to permit a 30% increase in production.

Eldon Fiberglass Mfg. Co., Aircraft Div., 8775 Mettler St., Los Angeles, Calif., has added 40,000 sq. ft. to its facilities. The expanded plant, directed by **Darrel E. Francy,** general manager, is equipped for research, prototype work, and volume production of fibrous glass-reinforced phenolic, polyester, epoxy, and silicone resins.

Pyramid Plastics, Inc., 554 W. Polk St., Chicago, Ill., has added two new extrusion machines and doubled the floor space it previously occupied.

The company extrudes thermoplastic materials and fabricates complete assemblies from plastic pipe, tubing, and rod.

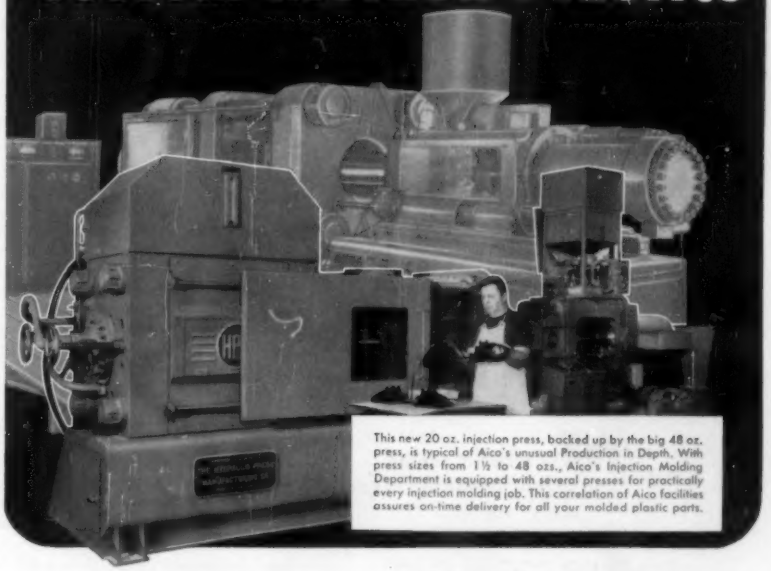
Chicago Rawhide Mfg. Co., Elgin, Ill., has opened a new **Special Polymer Section** in its Sirvene Div. Products manufactured by

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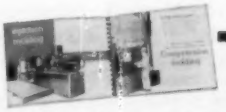
This new 20 oz. injection press, backed up by the big 48 oz. press, is typical of Aico's unusual Production in Depth. With press sizes from 1½ to 48 ozs., Aico's Injection Molding Department is equipped with several presses for practically every injection molding job. This correlation of Aico facilities assures on-time delivery for all your molded plastic parts.

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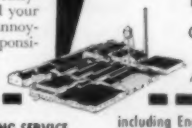
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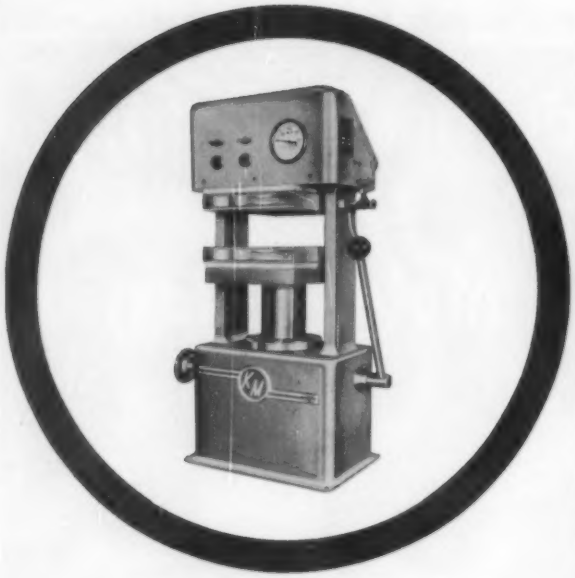
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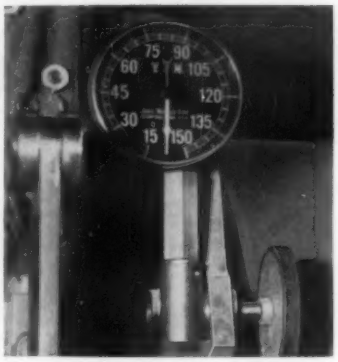
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Wheel rides on work— eliminates linkage — According to an important manufacturer of dyeing and printing machines in the textile field, the Surface Speed Indicator assures greater accuracy because it derives its speed directly from the material itself or the surface on which the material is moving instead of by means of mechanical linkages and gears.

Jones Motrola Corporation has been building tachometers for every conceivable type of application for over 35 years. Jones Tachometers are considered indispensable to proper production and quality control in such industries as automotive, textile, paperboard and machine tooling.

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the firm in this 12,500-sq. ft. addition will include oil seals, diaphragms, packings, and other custom molded parts made from the Silicones, Kel-F Elastomers, fluororubbers, and Teflon.

Meetings

Plastics group

October 10-11: The Society of the Plastics Industry, Inc., Thirteenth Annual New England Section Conference, The Wentworth-by-the-Sea, Portsmouth, N. H.

Other meetings

June 30-July 3: Housewares Shows Corp., Second International Housewares Show, Coliseum, New York, N. Y.

July 8-12: National Housewares Manufacturers Association, Exhibit, Atlantic City Auditorium, Atlantic City, N. J.

July 10-20: International British Plastics Exhibition, Grand and National Halls, Olympia, London, England. Additional information may be obtained from John L. Wood, British Plastics Exhibition, Dorset House, Stamford St., London, England.

July 14-19: Ninth Annual National China, Glass, and Tableware Show, Hotel New Yorker, New York, N. Y.

August 25-28: National Association of Furniture Manufacturers, Third Supply, Equipment, and Fabric Fair and Twenty-ninth Annual Convention, Conrad Hilton Hotel, Chicago, Ill.

September 15-18: American Institute of Chemical Engineers, Meeting, Lord Baltimore Hotel, Baltimore, Md.

September 15-18: Produce Packaging Association, Seventh Annual Produce Packaging Show and Conference, The Shoreham Hotel, Washington, D. C.

September 17-18: Building Research Institute, Meeting of Plastics Study Group, Washington University, St. Louis, Mo. Subject: "Plastic Materials for Roof Construction."

September 24: Packaging Association of Canada, Point-of-Purchase and Technical Institute Seminars, Building Centre, Toronto, Ont.

October 1-3: United States Army, in cooperation with the Departments of the Navy, Air Force, and Commerce, and the National Security Industrial Association, Third Joint Military-Industry Packaging and Materials Handling Symposium, Fort Lee, Va.

October 7-8: Technical Association of the Pulp and Paper Industry, TAPPI Plastics-Paper Conference, Sheraton-Gibson Hotel, Cincinnati, Ohio.

October 22: Packaging Association of Canada, Canadian Package Design Council and Technical Institute Seminars, Building Centre, Toronto, Ont.

October 28-31: Society of Industrial Packaging and Materials Handling Engineers, National Industrial Packaging and Handling Exposition, Convention Hall, Atlantic City, N. J.

Companies . . . People

The General Tire & Rubber Co.: Robert B. Wilbur, formerly manager of polyurethane product sales, promoted to general sales manager. He will direct sales of all products manufactured at the company's Marion, Ind., plant, including polyurethane foam and glass-reinforced plastics laminates. **Fred W. Dover** continues as sales manager of fibrous glass products.

Textileather Div.: Irving Zweig, formerly New York special sales representative, named Northeastern U. S. district sales manager; **John L. Howald,** previously product manager at Toledo, appointed assistant district sales manager for the same territory.

W. R. Grace & Co.—The Cryovac Co.: David H. Taylor, with Cryovac since 1945, named to newly created post of director of marketing. **William Harrison** appointed division sales promotion manager for the Western Div., operating out of the Denver office; he will be responsible for all sales promotion activities in the western area, reporting to the Western Div. sales manager, **Douglas B. Stirling** in Cedar Rapids, Iowa. **William Squire** is now sales promotion manager for the Southern Div., with headquarters at Simpsonville, S. C. **Donald K. Beyer** continues as Eastern Div. sales promotion manager.

B. F. Goodrich—B. F. Goodrich Industrial Products Co.: A. B. Gordon, appointed product manager of the Koroseal Film and Coated Fabrics Dept. in Plastic Products, will be responsible for pricing and development.

B. F. Goodrich Chemical Co.: Frank W. Silva, with BFG since 1939, named technical service manager for associate company relations in foreign countries.

Monsanto Chemical Co.—Plastics Div.: C. F. Brunson, formerly sales manager of the Western Adhesives Dept. and Seattle district manager, promoted assistant to the director of sales, resin products, Seattle. **A. L. Bonutto** named sales manager, Western adhesives sales, and Seattle district manager. **Milton Freifeld,** former senior research chemical engineer at Springfield, Mass., now laboratory supervisor at Addyston, Ohio.

Union Carbide Corp.—Bakelite Co.: Robert D. Swain, named technical representative for the Surface Coatings Div. in a newly established district office in Washington, D. C., will handle vinyl, polyethylene, polystyrene, phenolic, and epoxy surface coating resins. **Hugh S. Carpenter** appointed technical representative for the Flexible Packaging Materials Div. at the Clifton, N. J., district office; he will be responsible for the sales and servicing of polyethylene resins and compounds for thin film extrusion, Krene cast vinyl films for packaging, and Vinylite resin-coated paper for bottle cap liners. **Allyson S. Burhans** named group leader of the Polymerization Resins Group in the Development Laboratories at the River Road plant, Bound Brook, N. J.

Union Carbide Chemicals Co.: R. M. Joslin named manager, Fine Chemicals Dept., a position formerly held by **W. A. Woodcock** who has been appointed sales manager, Industrial Chemicals, which was Mr. Joslin's previous assignment. Both appointees have been with the company for over 20 years.

Union Carbide Development Co.: R. E. Cornwell, with Union Carbide since 1923, appointed president.

Chicago Molded Products Corp.: A 20¢ dividend payable July 15 to stockholders of record June 14 was declared at a recent meeting. Officers re-elected are as follows: **John J. Bachner,** president and general manager; **Edward F. Bachner,** chairman; **Louis H. Bachner,** vice president and treasurer; **Lloyd W. Anderson, Edward F. Bachner, Jr.,** and **James E. Johnston,** vice presidents; and **Lee C. Andrews,** secretary and controller.

Mannesmann-Easton Plastic Products Co., Inc. is the new name of the company formerly known as Easton Plastic Products Co., Inc. There has been no change in management or policy. The company, located in Easton, Pa., is a custom extruder. The parent company, Mannesmann, which is reflected in the new name, produces plastic tubing and other products.

The Richardson Co.: John T. Sullivan, Edwin Y. Chung, and **Leo J. Martin** appointed to newly formed Commercial Development Dept.; they will be responsible for the development of markets for new plastics products and will participate in the planning of Richardson diversification programs. The company does custom molding and laminating.

The Atlas Mineral Products Co., Mertztown, Pa., has opened a branch engineering office at 5907 Penn Ave., Pittsburgh, Pa., to service industry requiring corrosionproof material

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Companies . . . People

and construction in the Pittsburgh-Cleveland industrial area. **Thomas K. Piper** appointed engineering manager in charge of the new office.

Atlas, founded in 1892, is a subsidiary of **Electric Storage Battery Co.** It manufactures a complete line of corrosionproof cements, linings, rigid plastic structures, and pipe jointing compounds, and through the Contracting Div. installs these materials throughout the world.

The Goodyear Tire & Rubber Co., Inc.—Chemical Div.: E. C. Brown, Jr. appointed New York field representative, succeeding **J. Drexler** who was transferred to **Goodyear International Corp.** Mr. Brown will service plastic and rubber processing companies.

Films and Flooring Div.: Richard T. Clatterbuck named Chicago field representative for packaging film sales and **Anthony G. Dubrick** Chicago field representative for flooring sales.

Haveg Industries, Inc.: Warren J. Flynn appointed district sales engineer at the Chicago office. **George M. D. Hart** named to sales office at sales headquarters and home plant in Wilmington, Del. **James M. Brady,** with the company since 1945, appointed to the newly created post of assistant general sales manager of the **Pla-Tank Div.** which produces reinforced plastics. He is succeeded in his former sales position by **John H. Leary.**

Flexonics Corp.: Yaco, S.A., Buenos Aires, Argentina, hose manufacturer, licensed to manufacture Flex-O-Tube synthetic and plastic hose assemblies. **Robert F. Barge,** formerly with Goodall Rubber Co., appointed sales engineer for the Lake Erie and St. Lawrence area, with headquarters in the firm's Cleveland district office.

Cadillac Plastic & Chemical Co. appointed national distributor for the **United Merchants Industrial Fabric's** line of fibrous glass cloths and woven rovings.

Ferro Chemical Corp. has established a sales office at 507 Fifth Ave., New York, N. Y. **Saul Gobstein,** appointed technical sales representative for the New York and New Jersey territories, will be in charge of the New York office. Ferro makes heat and light stabilizers for p.v.c.

Devcon Corp.: Following industrial suppliers appointed: **Tidewater Supply Co., Inc.,** Norfolk, Va.; **Harry P. Leu, Inc.,** Orlando, Fla.; **Tropical Supply, Inc.,** Corpus Christi, Texas; **Western Belting & Mechanics, Inc.,**

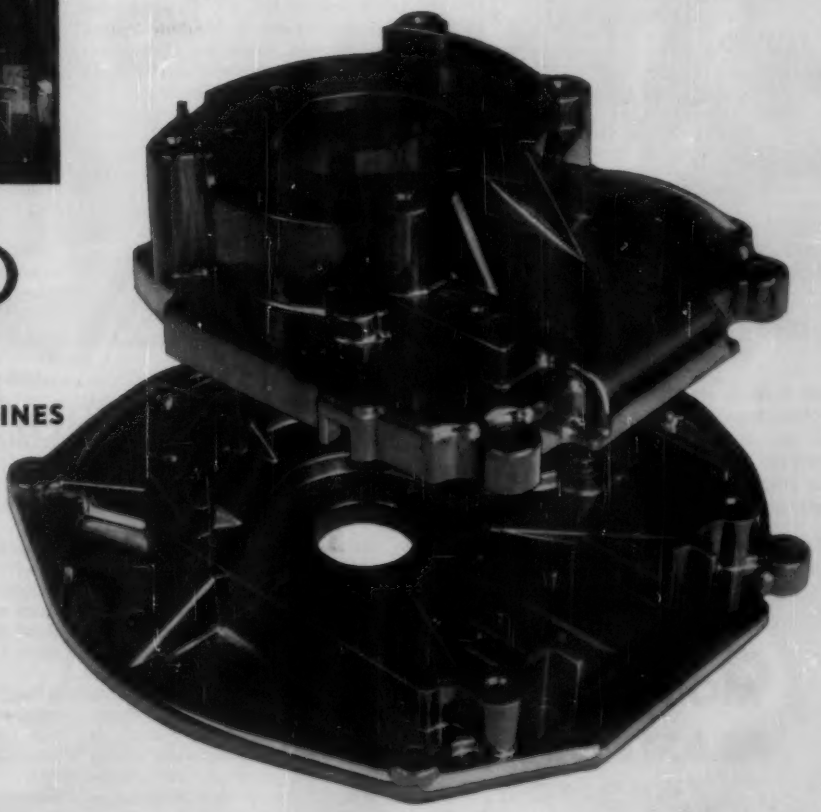
The Hoover Company switched to *fully automatic* molding of the upper section of this vacuum cleaner motor casing . . . labor cost dropped from 1¼ manhours to 1/10 manhour per 100 parts. Anticipated $7500-a-year savings will quickly pay off the cost of the new Baker 150-ton presses. The lower section of the motor casing (newly redesigned) is the largest phenolic part ever molded automatically anywhere! Write Baker Brothers, Inc., 1010 Post Street, Toledo 10, Ohio.

Switches to Baker automatic molding and saves $7500 a year



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INJECTION PRESS. Folder contains specifications and illustrations of 2¾ oz. injection press. Also illustrates compression presses manufactured by this company. Clifton Hydraulic Press Co. **(G-703)**

PRINTING ON PLASTICS. Illustrated literature describes hand-operated printing presses for printing on curved, uneven, or flat surfaces of plastics or other materials such as metal, glass, wood. International Marking Machine Co. **(G-704)**

VINYL PLASTICIZER. Technical data bulletin gives information on all-polymeric permanent plasticizer for vinyl. Includes data on properties, compatabilities, compounding, and applications. Harchem Division, Wallace & Tiernan. **(G-705)**

PROCESSING EQUIPMENT. Literature describes line of injection presses with 1, 2, 2¾ oz. capacities. Also describes company's mold base assemblies and a scrap granulator. The Van Dorn Iron Works Co. **(G-706)**

Just turn to the Manufacturers' Literature page in this issue (it's printed on heavy paper), circle the numbers corresponding to the booklets you want, fill in the reply postcard, and mail. No postage needed.

We'll see that your request is routed to the manufacturers promptly.

A Service Of

MODERN PLASTICS

A Breskin Publication

575 Madison Ave., New York 22, N.Y.

Companies... People

Los Angeles, Calif.; and **Sterling Products Co., Inc.**, Moline, Ill. Devcon manufactures "plastic steel" used to repair machines in the production of tools, jigs, and molds.

The Dow Chemical Co. has established a plastics technical service and development center in California, adjacent to its Torrance operation.

Precision Plastics, Philadelphia, Pa., **Star Foundry**, Fort Wayne, Ind., and **General Mold Casting**, Newark, N. J., have been licensed by **Shaw Development Corp.**, Port Washington, N. Y., to produce cavities and cores by the Shaw Process of precision investment casting.

The Kendall Co.—Polyken Sales Div.: Farwest Corrosion Control Corp., Seattle, Wash., and **William Cluff Corp.**, Tulsa, Okla., enfranchised distributors of Polyken's polyethylene protective tape coatings line for the West Coast and Rocky Mountain states, respectively.

Cameron Machine Co., 61 Poplar St., Brooklyn, N. Y., manufacturer of slitting and roll winding equipment, named exclusive distributor for Tidland pneumatic shafts produced by **Tidland Machine Co.**, Camas, Wash. The shafts are widely used on web-fed processing machines in the plastics, paper, printing, packaging, and other industries.

Chugai Boyeki Co., Tokyo, Japan, appointed exclusive Japanese sales representative by **Frank W. Egan & Co.**, Somerville, N. J., manufacturer of extrusion machines, dies, and accessories. The Boyeki firm's New York affiliate is **Robeco Technical Equipment Corp.**

R. E. Workman, manager of the Chemical Div. of **Goodyear International Corp.**, a subsidiary of **The Goodyear Tire & Rubber Co., Inc.**, is one of 36 men chosen from a wide range of industrial concerns throughout the United States, Canada, and Mexico to be awarded a **Sloan Fellowship** for participation in the executive development program at **Massachusetts Institute of Technology**. By carrying on their work at a technological development center such as M.I.T., they are given special opportunity to view long range development of business in the perspective of technological advance, as well as within the economic and human framework of management problems. The program emphasizes orientation to fundamentals underlying management action, rather than a review of management policies and techniques.



R. E. Workman

Mr. Workman has been with Goodyear since 1942, starting with the Research Div. as a chemist. He was transferred to the Chemical Div. in 1947; in 1952, he was appointed manager of commercial development, made assistant to the general manager of the division, and took over his present duties this year.

C. Russell Mahaney, vice president of **St. Regis Paper Co.** and general manager of its **Panelyte Div.**, elected president of **The Society of the Plastics Industry, Inc.**, for a two-year term, as well as to the S.P.I. board of directors.

Daniel P. Shedd, formerly with Monsanto Chemical Co., now sales development specialist of **Mobay Chemical Co.**, St. Louis, Mo. He will provide additional liaison betwee: Mobay's Sales and Research Depts. in the development of new product applications for urethane foams and related urethane products.

Robert J. Barbour, formerly advertising manager of Bakelite Co., appointed director of marketing of **Gering Products, Inc.**, Kenilworth, N. J.

Dr. L. H. Sutherland, appointed section head in the research program of **Escambia Chemical Corp.**, will be in charge of the analytical and certain of the process groups. He was formerly with American Cyanamid Co.

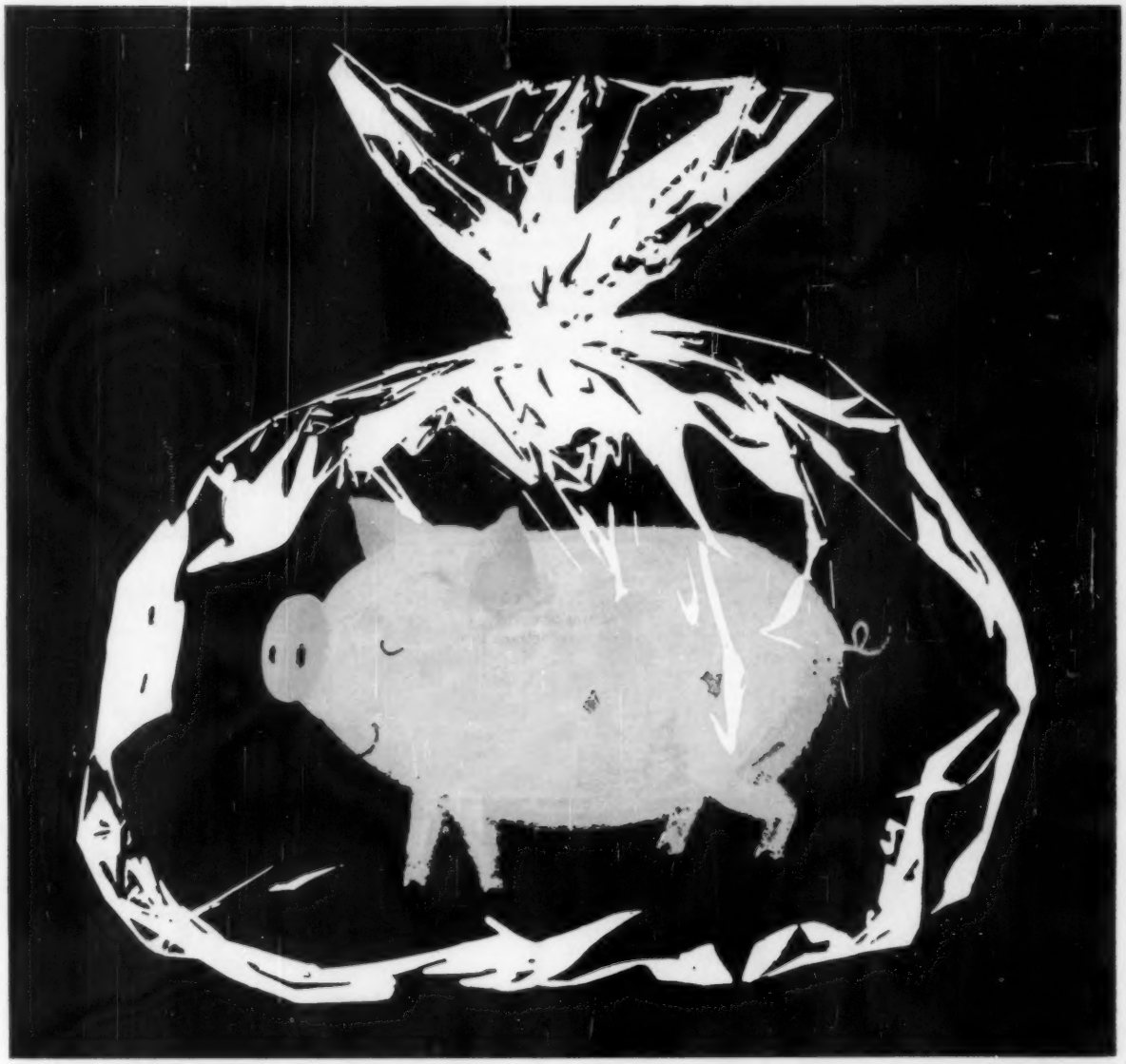
William H. Shields, assistant to the research director of **Emery Industries, Inc.**, retired after 32 years with the firm. He directed the planning and erection of Emery's Twitchell Memorial Laboratories, which were dedicated in 1955.

Robert A. Howard named head of Laboratory Research and Process Development Dept. of **Tumb-L-Matic, Inc.**, New York, N. Y., manufacturer of finishing equipment.

Peter F. Zachares, formerly with Du Pont and Interchemical Corp., named sales engineer in the New York metropolitan area for **Rodney Hunt Machine Co.'s Process Equipment Div.**

Albert R. Pollack, formerly plastics engineer of RCA, now manager of the Reinforced Plastics and Foam Dept. of **Strick Plastics Corp.**

Samuel H. Tinsley has retired from **R. T. Vanderbilt Co.** He has been with the company for over 20 years engaged in development work and technical sales and service. Mr. Tinsley's retirement results from a



Happy home for packaged foods

. . . made with Paraplex G-62 plasticizer*

Vinyl films made with PARAPLEX® G-62 plasticizer protect the flavor and appetizing appearance of all kinds of packaged foods—meats, poultry, fish, lard, fats, oils, margarine, frozen foods, as well as fresh fruits and vegetables.

They're all safe with PARAPLEX G-62 . . . because this plasticizer is non-toxic, low in odor and taste. In addition, PARAPLEX G-62 is an effective stabilizer for all chlorinated polymers—films resist discoloration during high temperature processing in milling, extruding and calendering.

**Acceptable to the* FOOD AND DRUG ADMINISTRATION AND THE MEAT INSPECTION BRANCH OF THE U. S. DEPARTMENT OF AGRICULTURE.

For more information on *all* of the plasticizers produced by Rohm & Haas Company, write for *What You Should Know About* PARAPLEX *and* MONOPLEX® *Plasticizers.*

Chemicals for Industry

ROHM & HAAS COMPANY

THE RESINOUS PRODUCTS DIVISION

Washington Square, Philadelphia 5, Pa.

Representatives in principal foreign countries

Quality controlled 'deeglas'
in this all-plastic u.d. milk float



This all-plastic milk float, manufactured by Mickleover Transport Ltd. for United Dairies, employs **deeglas** chopped strand mat as its sole reinforcing material.

All **deeglas** products, chopped strand mat, glass rovings and deeformat, are produced under a quality control system based on the requirements of BS.600 and BS.600R. This ensures the consistency so essential for perfect mouldings.

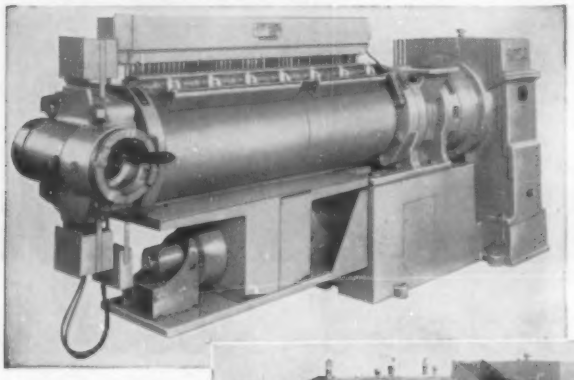


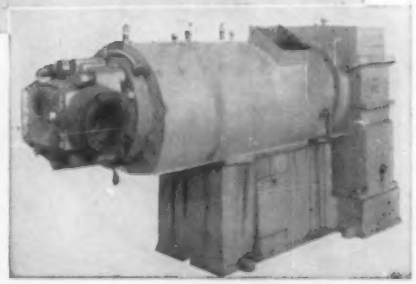
deeglas

Chopped strand mat and deeformat in standard and roof-lighting grades. Glass rovings.

Glass Yarns & Deeside Fabrics Ltd. 44-46 Kingsway, London, W.C.2 Telephone Chancery 7343 and 8257

MIR 8201





8½" Spirod extruder with side delivery head for jacketing. Up-graded from circulating type shown to the right.

EVER THINK OF UP-GRADING TO SPIROD®?

Yes, it can be—and is being—done. And Royle's traditional approach to extruder development, the retention of features that have stood the test of time, makes it possible. The one-piece cylinder with built-in hopper is replaced by a separate cast steel hopper section, a cast steel cylinder with deep grooves that create fin-like separations for the rod type heating elements and the selective evaporative cooling equipment. Head and stock screw, as usual, are designed for process requirements.

If you are operating an older type Royle extruder you should investigate up-grading to Spirod—the electrically heated extruder with high velocity evaporative cooling—for maximum efficiency in controlled operating temperatures.

Write for Bulletin # 463

JOHN ROYLE & SONS ROYLE PATERSON N. J. 1880

PIONEERED THE CONTINUOUS EXTRUSION PROCESS IN

London, England	Home Office	Akron, Ohio	Los Angeles, Cal.	Tokyo, Japan
James Day (Machinery) Ltd.	V. M. Hovey J. W. VanRiper	J. C. Clinefelter	H. M. Royal, Inc.	Okura Trading Co., Ltd.
Hyde Park 2430 - 0456	SHerwood 2-8262	BLackstone 3-9222	LUdlow 9-3261	(56) 2130 - 2149

heart attack he suffered nearly a year ago. He plans to move to Florida in the near future.

Harriet Raymond, advertising manager of the **Plastics Div.** of **Celanese Corp. of America**, has been re-elected president of the **Advertising Women of New York, Inc.** In 1945, Miss Raymond was named outstanding advertising woman of the year by the Chicago Women's Advertising Club. She is a member of The Society of the Plastics Industry, Inc. and serves on two of its public relations committees. Miss Raymond is also a member of the nominating committee of the Advertising Federation of America.



H. Raymond

Don Lence named sales manager of **Multiplastics**, Addison, Ill. The firm produces bulletin billboard trims, plastic letters, and three-dimensional display spectaculars made of plastic and glass-polyester.

Trevor W. Moore, formerly with Special Products Div., Bernard Edward Co., has joined **The Vlchek Tool Co.'s Plastics Div.** engaged in plastic sales and product development.

Dr. Jerry M. Howald, formerly with Shell Chemical Corp., Houston, Texas, appointed to research staff of **Glaskyd, Inc.**, Perrysburg, Ohio. Glaskyd furnishes general-purpose glass-reinforced thermosetting molding compounds.

William E. Hughes appointed to the Washington Div. of **Container Laboratories, Inc.**

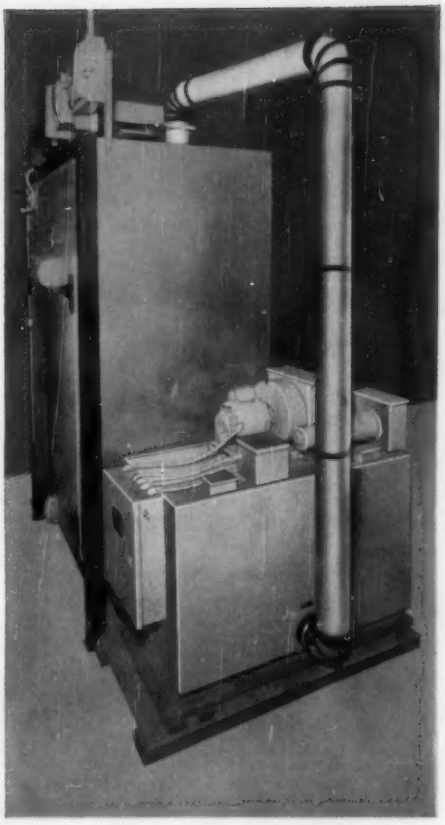
Arthur E. Backus, formerly with Chicago Molded Products Corp., named sales manager for industrial products at **Victory Mfg. Corp.**, Chicago plastics molder.

John Ware has resigned as vice president in charge of sales, treasurer, and director of **Kenrich Corp.** The firm produces a line of hydrocarbon plasticizers.

Gilbert G. D'Andrea appointed director of product development engineering of **Durable Formed Products, Inc.**

Morton M. Gruber, previously sales manager of Archer-Daniels-Midland Co.'s Resin Dept., appointed sales manager for surface coatings resins of **Reichhold Chemicals, Inc.**, White Plains, N. Y.

Don't let high humidity affect your quality... Get maximum oven efficiency by using DRY AIR from a



Dryomatic dehumidifier

The removal of moisture from the intake air on an oven is an important step forward in control of injection molding. This is particularly true in the case of nylon where an oven actually adds moisture to the material on humid days. Considerable improvement in efficiency can be attained in drying all plastic materials by the use of the Dryomatic Model 105-P which delivers a CONTINUOUS FLOW of dry air. A smaller Model, the 25-CT, is available for a semi-continuous supply of dry air.

manufactured by Dryomatic Alexandria, Virginia

The Rainville Company
National Representatives
224 SEVENTH STREET • GARDEN CITY, N. Y.
OFFICES IN: New York, N. Y.; Framingham, Mass.; Philadelphia and Franklin, Pa.; Miami, Fla.; Detroit, Mich.; Chicago, Ill.; Dayton, Ohio; St. Louis, Mo.; Dallas and Houston, Texas; Minneapolis, Minn.; and Los Angeles, Calif.

Classified Advertisements

Modern Plastics reserves the right to accept, reject or censor classified copy.

Employment

Business opportunities

Equipment

Used or resale only

Machinery and equipment for sale

FOR SALE: 1-Baker Perkins size 15USE, 100 gal. all stainless double arm Vacuum Mixer; 1-Baker Perkins size 15VUMM, 100 gal. double arm Mixer, 100 HP motor; 6-day 250 and 100 gal. double arm Mixers; 1-Ball & Jewell #1 Rotary Cutter; 2-Two Roll Mills 6"x12"; 6-Stokes Model DD2, DS3, D3 and B2 Rotary Preform Presses; 4-Stokes Model "R" single punch Preform presses; 1-Kux Model 15-25 Rotary Preform Press; Also: Sifters, Banbury Mixers, Powder Mixers, etc., partial listing; write for details; we purchase your surplus equipment; Brill Equipment Co., 2407 Third Ave., New York 51, N.Y.

FOR SALE: Surplus equipment—Injection Molding Machines up to 60 oz.—Compression Molding Presses—50 ton 12" x 12" Laboratory Presses—Carver Laboratory Presses rebuilt and guaranteed—6" x 13" Laboratory Mills—¾" Double Solenoid Control Valves 3000 psi—Partial List—Send us your inquiries. Plastic Machinery Exchange, 426 Essex Avenue, Boonton, N. J.—Telephone DEerfield 4-1615.

FOR SALE: Dual Pumping Units in stock, Custom Built: Rebuilt Hydraulic Presses Baldwin 8 openings 42" x 42" 700 ton; Baldwin 26 x 26" 50-75 tons; D & B 10-60 tons 12" x 12"; Laboratory Presses, Preform Machines, etc. Universal Hydraulic Machinery Co., Inc., 285 Hudson St., New York 13, N.Y.

FOR SALE: (6) 100 ton, 10" ram, 10" stroke @ $1250; (7) 200 ton. 9" stroke, 14" ram, 36x36, @ $2150; (6) 200 ton, 9" stroke, 15" ram, 30x30 @ $1850; (1) ton complete, 18x18 @ $1850; (1) 200 ton 16" ram, 30x30 @ $2450; (2) 200 ton 16" ram, 42x42 @ $2850; (1) 200 ton, 15" ram, 42x42 @ $2600; (3) 250 ton (2) 12" ram, 30x60 rebuilt @ $3675. Hydraulic Sal-Press Co., Inc., 386-90 Warren Street, Bklyn, N.Y.

FOR SALE: 1 Adamson 26 x 84" plastics mill, vari-speed drive; 1—26 x 50—4 opening hydraulic press, 2—12" rams; 3 Stokes T, RD-3, RD-4 tablet presses; 1 Hartig 2" electric extruder; 3 Cumberland #1/2 granulators, 3 HP; also mixers, cutters, presses, etc. Chemical & Process Machinery Corp., 52 Ninth St., Brooklyn, N.Y.

FOR SALE: Surplus Molding Machine parts. Reply Box 2413, Modern Plastics.

FOR SALE. Just released by one of the largest plastic molders the following "HPM" Horizontal Hydraulic Injection Molding Machines. We have (1) "HPM" 350 H 12 oz., (5) "HPM" 200 H 9 oz., (1) "HPM" 100 H 4 oz., all machines are late models and have been operating about 50% of the time. They have had the best maintenance by expert operators and maintenance men and just recently have been completely overhauled. Just hook them up and you're in business! We also have one Lester 12 oz. fully automatic plastic injection machine and two Lester 6 oz. (Model 2B) plastic injection machines. We have a Stokes Model "F" Preform Press, Stokes Tablet Press Model S4 (40 ton); Stokes Tablet Press Model P3 (80 ton); Kux Tablet Press Model 64 (35 ton); Colton Tablet Press No. 5 (25 ton); Stokes Model 43A Oscillating Granulator with stainless discharge hopper; Day type C (80 gal.) Blender with stainless body. All the equipment we offer is in prime condition and we will quote attractive prices.
GLOBE TRADING COMPANY, 1815 Franklin Street, Detroit 7, Mich. Phone-Woodward 1-8277.

FOR SALE: Vacuum Metallizer 36".—Injection Presses: 8,12,16 oz Reed, 4,9,16,20 (1954) oz HPM, 8 oz Lester, 8 oz vertical Giddings, 4 oz Lewis, 4 oz vertical DeMattia, 1.2 oz Van Dorns. Extruders: New 3" Bandera, Stokes-Windsor Twinscrew RC 100, 2½" Hartig. 24", 30" Sheet Dies, 30",52" Pull-Offs, 48" Sheet Stacker. 14", 36" Dulmage Meter Pumps. Conveyors. Despatch 48"x72" Sheet Preheat Oven. Cumberland model O & Leominster 5 HP grinders.—Apex 2 color Container Imprint mach.—Compression & Transfer presses 50 to 600 T. Elmes Hydrolair press 30 T. La Rose Champ & mod. 50 Electronic Preheaters. Stokes 280 G Preformpress. Baker-Perkins 200 gal. Mixer 42 cu. ft. Robinson Ribbonmixer. 40"x60" Vac. Form. Mach. List your Surplus Equipment with me.—All Midwest locations.— Wanted 50 T Stokes Standard Comp. press 24 oz, 32 oz HPM or Watson. 1½" to 6" Extruders. Justin Zenner, 823 Waveland Ave, Chicago 13, Ill.

FOR SALE: Available at bargain prices: Baker Perkins 50 gallon Steel and Stainless Steel Steam Jacketed Heavy Duty Mixers with Stainless Jacketed Blades, motorized power tilting, motor driven. W & P 200 gallon Heavy Duty Mixer, tilting type, with Sigma Blades. J. H. Day from 1 qt. to 150 gal., Imperial and Cincinnatus D.A. Jacketed, Sigma Blade Mixers. Day 15 to 10,000 lbs. Dry Powder Mixers. Mikro Bantan, 1SH, 1F, 2TH, 3TH Pulverizers. Day, Rotex, Tyler-Hummer, Great Western Sifters. Package Machy. FA, FA2, FA4, Miller, Hayssen, Scandia, Hudson Sharp, Oliver Auto. Wrappers—all sizes. This is only a partial list. Over 5000 machines in stock available for immediate delivery. Tell us your machinery requirements. Union Standard Equipment Co. 318-322 Lafayette St., New York 12, N.Y.

FOR SALE: One 2½" NRM oil-heated extruder 1941 model. Rebuilt—excellent condition. Reply Box 2404, Modern Plastics.

LIQUIDATION.
Transfer Molding Presses
Late type-self contained
1—300 ton Stokes
2—200 Ton Baldwin-Southwark
2—150 ton Stokes
1—100 ton Stokes
10—Thermall Preheaters.
Reply Box 2418, Modern Plastics.

FOR SALE: 2500 Ton downstroke 54" x 102". 800 ton laminating press with 23 openings 26" x 38". 500 ton Baldwin downstroke 32" x 36". 300 ton upstroke press 22" x 35". Elmes 200 ton 28" x 26". Farrel 200 ton 30" x 30". 200 ton Hobbing Press 18" x 14". D & B 140 ton, 36" x 36". Adamson 80 ton 20" x 20". Farrel 200 ton 20" x 80". French Oil 120 ton self-contained 18" x 22". Also Lab to 2500 tons from 12" x 12" to 48" x 48" Hydr. Pumps and Accumulators. Stokes Automatic Molding Presses. Van Dorn 1 oz. Injection Molding Machine. Mills and Calenders to 84". Seco 6" x 13" and 8" x 16" Mixing Mills and Calenders. Plastic and Rubber Extruders. Oxford 57" Slitter. Rotary and single punch Preform Machines, 1/2" to 4". Injection Molding Machines 1 oz. to 60 oz. Baker-Perkins & Day Jacketed Mixers. Ball & Jewell #1—15 HP Plastic Grinder, and other sizes. Gas boilers. Partial listing. We buy your surplus machinery. Stein Equipment Co., 107-8th Street, Brooklyn 15, N. Y. Sterling 8-1944.

SAVE 20% on Thermall Preheater Model 1000 for Plastic or Rubber cost over $7000. Will sell for 20% less or best offer. Unused, in original factory crate. Program changes make unit surplus. Capacity 15 lbs. For large loads or general purpose preheating. Contact Mr. R. T. Morris, Research Division, United Shoe Machinery Corp. Beverly, Mass., WAlker 2-160.

FOR SALE: 1955 Farrel Birmingham 4 Roll Calender, 8" x 16", with 15 HP Motor & Converter, Like New. 2—W&P Heavy Duty Mixers, Jktd. 15 gal, cap, with 15 H.P. motors. Ball & Jewell #1½ rotary cutter, with 30 H.P. motor. Equipment Clearing House, Inc., 111 33rd Street, Broklyn 32, N.Y. South 8-4451—4452—8782.

FOR SALE: 1—22 oz. Lester Injection Molding Machine—1947—used only very little—excellent condition—can be seen in operation any time. Two 8 oz. Lester Injection Machines—1946—also excellent condition and running at present. Reply Box 2420, Modern Plastics.

FOR SALE: 1 oz. Van Dorn, hand, $375; 2½ oz. Van Dorn fully aut.; 4 oz. Lewis, 1953, $4,250; 6 oz. H.P.M., 1955; 4 oz. R-P w/8 oz. cyl., $4,500; 4 oz. special molding machines, $1,850. each; 3 oz. Fellows, 1951; 8 oz. Fellows, 1953; several 8 oz. Reed-Prentices; 9 oz. H.P.M., 1946, $5,500; 8 oz. DeMattia, toggle; 12 oz. DeMattia, Model C, terms; 12 oz. Impco vert.; 12 oz. DeMattia, 1946, toggle, $5000; 12 oz. Reed-Prentice, 1951; 16 oz. H.P.M., 1954; 16 oz. Reed-Prentice, 300T, 1954; 16/20 oz. Reed-Prentice, 1955; 20 oz. H.P.M., 1954; 22 oz. Impco vert.; 48 oz. Watson-Stillman, 1950; double end tumblers; grinders; ovens. Partial listing—other equipment available. Acme Machinery & Mfg. Co. Inc., 2315 Broadway, New York, N.Y. Su 7-1705.

(Continued on page 246)

plastics scrap...

We pay top prices for all types of plastics scrap and surplus virgin materials. Turn yours into cash.

CUSTOM COMPOUNDING TO YOUR SPECIFICATION

AMERICAN MOLDING POWDER AND CHEMICAL CORPORATION

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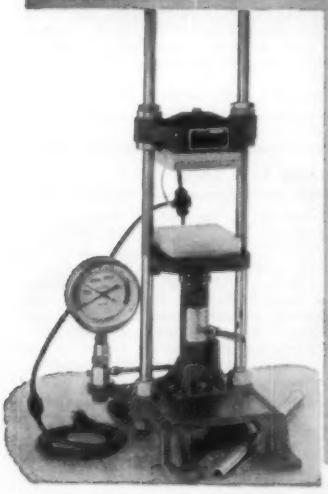
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Processors of Plastics Materials

The CARVER LABORATORY PRESS



...Solutions for Pressing Problems

Accurately controlled pressures to 20,000 lbs.; 6-inch gauge mounted on base. Carver Standard Accessories include Electric or Steam Hot Plates, Carver Test Cylinders, Swivel Bearing Plates, Cage Equipment. Available from stock. Write for catalog.

FRED S. CARVER INC.
HYDRAULIC EQUIPMENT
3 CHATHAM ROAD, SUMMIT, N. J.

IMS PURE SILICONE FLUID MOLD RELEASE SPRAY



EXCLUSIVE, FAST, ALL-METAL VALVE ENDS FUMBLING SAVES CYCLE TIME

Keeps Mold Lube Cost Down

It Isn't Size — It's Performance and Quality That Count!

PRICES (Delivered)
Sample Can $2.00
Per Unbroken Dozen $18.00
Per Unbroken Gross $197.40

The Economical Way to Buy and Apply Pure, Costly Silicone Fluid!

To Cover All Molding Conditions Keep Both Types on Hand

IMS PURE ZINC STEARATE DRY POWDER SPRAY



HANDY MOLD DUSTER

Quick—Convenient

Removable, Cleanable Spray Head Directs Dust Into Cavity Without Waste.

PRICES (FOB Cleveland)
Sample Can $2.00
Per Unbroken Dozen $13.80
Per Unbroken Gross $144.00

IMS Mold Releases are designed to bring you maximum quality and performance. Our Silicone Fluid Spray utilizes only more costly volatile Freon to minimize part marking on fast cycles. The Dry Powder Spray should be used in all applications where painting or plating follows the molding operation, also in preforming.

INJECTION MOLDERS SUPPLY CO.
3514 LEE ROAD • WYoming 1-1424 • CLEVELAND 20, OHIO

(Continued from page 244)

PLASTICS MACHINERY

Cutters, Rotary, Plastic
Cumberland #½ with 5 HP Motor
Ball & Jewell #1 with 10 HP MD
Ball & Jewell #2 with 40 HP MD, Extra Knives

Extruders
Hartig 2" Elec. Htd., 7½ HP Reliance V-S Drive, 98% New
Hartig 3½" Elec. Htd., 45" Barrel, 20 HP Reliance V-S Drive

Injection Molding Machines
2 Oz. Van Dorn, Oversize Cylinder, Model H-200
8 Oz. Reed-Prentice Double Link
16 Oz. Reed-Prentice No. 10-E-16, Elec. Htd., 1948

Mills, Rubber/Plastic
6" x 13" Lab Type with 5 HP MD
18" x 50" Farrel, Rubber/Plastic, 75 HP MD
22 x 60 Farrel-Birmingham with 150 HP MD & reducer. New & unused

Presses, Molding
15 Ton Baker Fully Automatic
15 Ton Stokes No. 200 D-2 Automatic (10)
15 Ton Dennison 12 Station Indexing Table, 10 HP MD Pump
30 Ton Baker Full Automatic Model 958, Excellent Condition, New 1951
40 Ton Francis, 4 Opening, 12" x 12" Elec. Heated Platens
50 Ton Stokes, Semi-Auto., Self Cont.
75 Ton Watson-Stillman Fully Automatic, 20" x 20" Platen 5 HP MD
100 Ton Stokes Standard Semi-Automatic, Power System, Timing Controls
100 Ton Lake Erie Hi-Speed, 24" x 24" Bed, 12" DLO, Self Cont.
113 Ton French Oil Mill, 6 Opening, Elec. Htd., Platens 15" x 18"
113 Ton R.D. Wood, 5-Opening Elec. Htd. Platens 14" x 20"
150 Ton Stokes Standard Semi-Automatic, Power System, Timing Controls
175 Ton Viceroy Slab-Side 24" x 24", Elec. Htd. Platen with Hand Pump
200 Ton Stokes Semi-Automatic, Power System, Timing Controls
225 Ton Farrel 14" Ram x 18" Stroke, L-R 26½" x F.B. 24½", 7½ HP MD
300 Ton Stokes Semi-Automatic, Power System, Timing Controls
314 Ton Lake Erie 36" x 36" Semi-Automatic, Push Button Controls 10 HP Pump & Motor
625 Ton Farrel, Steam Platens 52" x 52", Pump, Mtr., Controls, Under Power
669 Ton, Morane, 3 Upmoving Rams, 16" Stroke
700 Ton Erie, Multi-Opening 42" x 42" Steam Platens
4000 Ton Mesta, 3 Upmoving 30" Rams x 20" Str. Bed 34" x 351"

Presses, Hobbing
400 Ton Robertson 13" Ram x 4" Stroke complete with pumps & 15 HP MD

Furnaces and Ovens
Megatherm, 3/60/220, 3 KW, 2-3 lb. Phenolic Per Min. (8)
Despatch Mdl. P1hd-8 8 Drawers, 12 x 18 x 2½" (2)

Tablet Machines
Model "E" Stokes, Complete with MD
Model R Stokes, Single Punch, Variable Speed Motor Drive, 3 HP
No. RB-2 Stokes, 16 Station, Motor Drive, 2 HP
Model 45 Defiance, 200 Ton, 15 HP, Vari-Speed, MD
Model F, Stokes, Single Punch, MD
No. 5 Arthur Colton, Motor Drive, 3 HP
No. DDS-2 Stokes, 23 Stations, US Vari-Drive, 10 HP
Model T Stokes Hydraulic Equalizer, MD

Mixers
Model "B" Banbury Lab type, New & used
No. 3A Banbury, 150 HP Md Rubber/Plastic
No. 3 Banbury 75 HP MD Excellent Condition Slide Door Construction

Calenders
24" x 48" Farrel-Birmingham, 3 Roll, 50 HP DC Motor
9" x 48" American Tool 4 Roll Doubling, Belt Drive
6" x 13" Elec. Htd. 6 Roll Lab Type, 7½ HP MD

Pelletizers
Mitts & Merrill Model 10-N-6 15 HP V.S. Drive

Make Us Your Prime Source for All Types of Plastics Machinery
Hydraulic Presses from lab size to 5,000 ton
Injection Molders from ¼ oz. to 60 oz. size
Extruders from lab size to 12"
Plastic & Rubber Mills and Calenders up to 84" size
Tablet Preform Presses, single punch and rotary, all sizes
Mixers all sizes, types and capacities

Also a complete selection of tumbling barrels, take-up equipment, hydraulic power units, pumps, ovens, blenders, scrap cutters, pelletizers, coating equipment and laminating equipment.

JOHNSON MACHINERY Co.
683-P Frelinghuysen Ave., Newark, N.J.
What Do You Need? What Have You To Sell?

FOR SALE: 64 Oz. Injection Molding Machine with Pre-Plasticizer. 750 Ton Clamp. 12 oz. DeMattia molding machine. Good condition. Mold Size 32" vertical, 50" horizontal. 8 & 4 oz. Injection Molders. Aaron Machinery Co. Inc., 45 Crosby St., New York 12, N. Y. Tel.: WAlker 5-8300.

FOR SALE: 300 Ton W. S. Self Contained Compression, Mold 33½ x 27" x 18" stroke. Watson-Stillman—300 ton 20" x 20"—250 Ton. 28" x 24"—140 Ton 22" x 16". Waterbury-Farrel 85 Ton 20" x 24" —80 Ton 24" x 24". 63 Ton 15" x 15" with Pull Back Cyl. Lab Presses 10 & 15 Ton, platens 6" x 6" or 10" x 10". Many others. Accumulators, Valves, Pumps. Aaron Machinery Co. Inc., 45 Crosby St., New York 12, N.Y. Tel.: WAlker 5-8300.

FOR SALE: 6 oz. injection molding machines—1947 Lester, 1942 Watson-Stillman. 500, 1000 ton hydraulic presses. Stokes tablet presses—"R", "T", DD-2, RD-4, B & J "Std. Ideal" St.St. cutter. Sigma blade mixers, 2¼, 5, 10, 30, 50, 75, 100, 150 gal., Steel and St.St. vulcanizers, reactors, dryers. We are Buyers also! Perry Equipment Corp., 1429 N. 6th St., Phila. 22, Pa.

FOR SALE: 200 ton W.S. Bottom Transfer Molding presses, self-contained. 1948. Bed 30" x 30"; Royle 2" Extruder, Perfected #1, hardly used, reasonable. 32-22-16-12-8-6-4-2 oz. Reed, W. Stillman, Lester Injection Molding Machines; Cumberland Stair Step Dicer, 1953, four knife rotor, 15 HP 1800 rpm motor. #9 Standard Upacting Geared Toggle Press: 4 rod compound; 200 T. 24" x 24" platens; with roll feed and in excellent condition. Raw Material Mixing Plant; Complete, for phenolic molding and similar lines, never used, in original crates cost $250,000, conveyors, premixers, sifters, valves, crushers, scale, blenders, screen, dryer, dust collector, cutters. Will sell all or part. Sturtevent Blended #10, Cap. 300 CSM, 1947. Sturtevent Blender #12, Cap. 550 CSM, 1947. Excellent condition. Eveready: Box 638; Bridgeport, Conn. EDison 4-9471. E. J. McCallum, Jr.

Machinery and equipment wanted

WANTED: Model 10-D Reed & Prentice 8 ounce injection molding machine, must be 1950 or later make. Also molds suitable for this machine for making combs, houseware or school items. Advise price, conditions and serial number of machine. Reply Box 2406, Modern Plastics.

WANTED: One late model 3½" extruder for styrene with minimum barrel length 16½". Oil or Electric heat. Extruder must be in good condition. Reply Box 2414, Modern Plastics.

WANTED: 2 Model T Stokes Preform Presses. To be used for parts only, need not be in operating condition. Will sell 1 Defiance #20 Preform Press. Write Wiggins Plastic Molding Co., 10 Kingsland Road, Clifton, N.J.

Materials for sale

FOR SALE: Business manufacturing lighting fixture shades and lamp shades of laminated vinyl. Also other plastic products and wire items. Exclusive method of forming laminated vinyl. Complete wire fabricating equipment. Reply Box 2415, Modern Plastics.

FOR SALE: Heavy steel table with plastic surface (for use as surface plate) with Stanley router and router arm. Eastman Blue Streak cutter for glass mat etc. Devilbis spray gun, Type MBC. 24" and 30" bar clamps. Maumee Valley Plastics, Inc., Waterville, Ohio.

Materials wanted

WANTED: Plastic sheets: Close outs, over-runs, rejects. Styrene: All colors .015 to .030. Vinyl: All colors .010 to .015. Rigid only. Polyethylene: All colors .020 to .025 all colors. Acetate: .0075 to .020 all colors. We are manufacturers, not convertors or jobbers. Reply Box 2410, Modern Plastics.

VINYL SCRAP WANTED: Best prices paid for clean, uncontaminated vinyl scrap. Send samples and additional details. Reply Box 2407, Modern Plastics.

WANTED.
Clear Cellulose Acetate and other scrap from VACUUM FORMERS. Claude P. Bamberger, One Mount Vernon St., Ridgefield Park, N.J. Telephone: HUbbard 9-5330. Not connected with any firm of similar name.

WANTED.
Vinyl, polyethylene and styrene scrap for our manufacture of molding and extrusion compounds. We can use rigid from vacuum forming, lumps, bleeder, slabs, trimmings, rejects—anything suitable for reprocessing. Send samples and details or telephone. Steady buyers since 1940.
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MArket 4-4444

YOUR BEST MARKET for Surplus Molding Powders and Scrap Plastics—Gem City Trading. Contact Gem City for best prices on polyethylene, styrene, nylon, butyrate and acetate.
Gem City Trading—P. O. Box 941
Dayton 1, Ohio—HEmlock 2121

WANTED.
Plastics Scrap and Rejects of all kinds. Ground and unground. Also rejected molded pieces and surplus virgin molding powders. Top prices paid.
Reply Box 2402, Modern Plastics.

Molds for sale

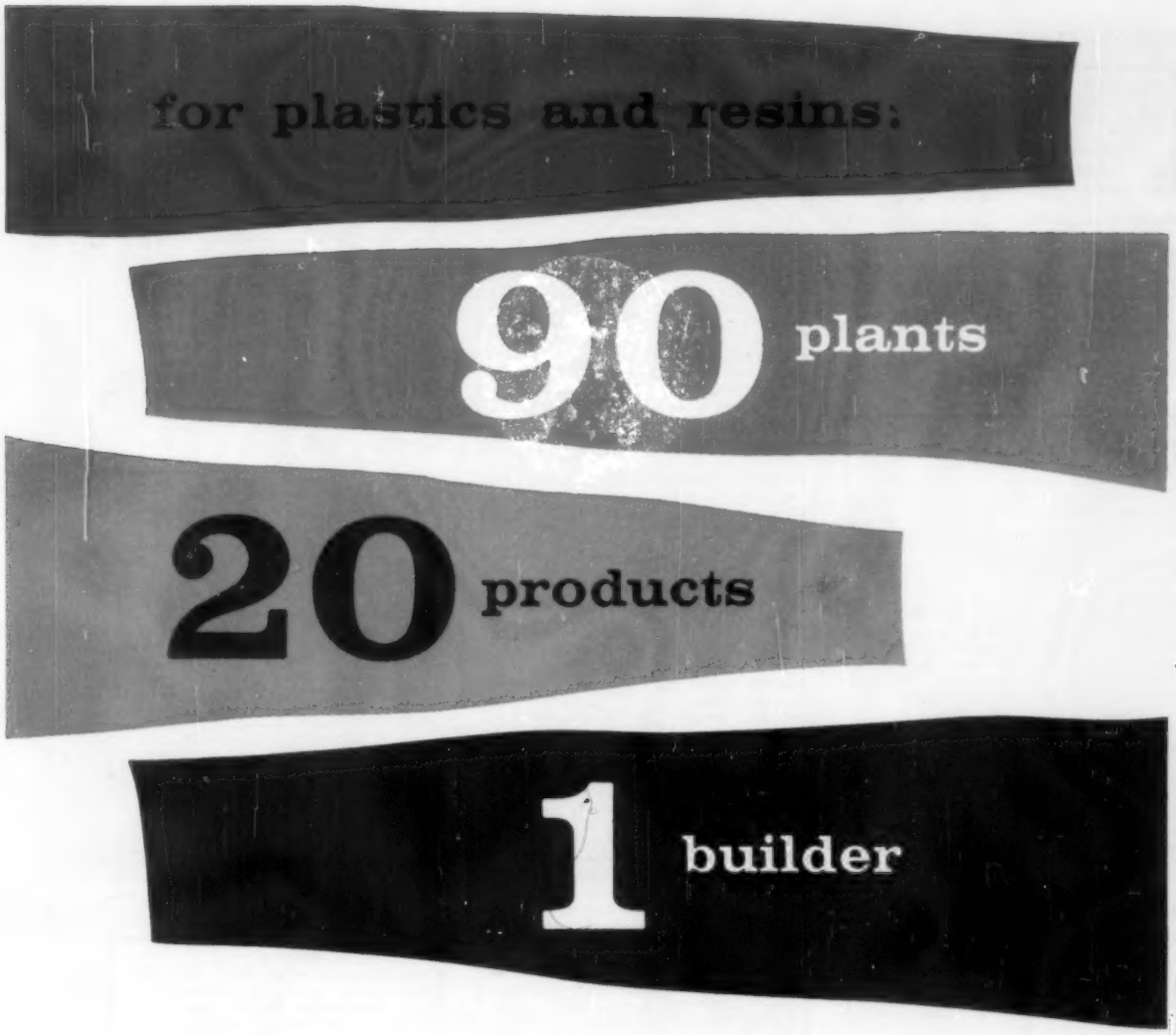
FOR SALE: A number of Compression Type Plastic Molds, to produce Ashtrays, Cigarette Caskets, Household Articles, Lipstick Cases, Flapjacks and Fancy Goods etc. All Molds in good condition. A once-in-a-lifetime bargain for an established manufacturer, or a rare opportunity for someone entering the manufacturing field. Write for complete information. Reply Box 2403, Modern Plastics.

FOR SALE: 51 Houseware Molds in good condition producing staple items all catagories. Items generated seven figure volume. Bargain priced, terms available. Reply Box 2416, Modern Plastics.

Help wanted

EXTRUSION SPECIALIST: Man with knowledge of all phases of the extrusion field, including machine set-up, die, design, ability to handle people. Reply Box 2400, Modern Plastics.

(Continued on page 248)



Blaw-Knox, pioneer in the industry, sets the pace in designing and building plants for polymer and resinous compound production.

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(*Continued from page 246*)

CHEMIST: Experienced in formulation and synthesis of chemicals for use as stabilizers in vinyls etc. Excellent opportunity. Location, Connecticut. R. T. Vanderbilt Co., Inc., 33 Winfield Street, E. Norwalk, Conn.

PLASTICS CHEMIST: Career opportunity in research and development of coatings and films on paper background. Thorough knowledge of polymer chemistry and paper coatings, also be familiar with supported and non-supported films. Leading packaging company plans extensive expansion program. Replies held in strict confidence. Salary open. Excellent fringe benefits offered. Send resume to Box 2405, Modern Plastics.

WANTED.
Experienced Man to take charge of extrusion of Polyethylene Tubular Film. Good salary and opportunity for right person. Reply Box 2421, Modern Plastics.

MANUFACTURERS AGENTS WANTED: We are manufacturers of top quality, precision heat and temperature industrial control equipment, utilizing heat transfer fluids. Selling to the injection molding and extrusion fields primarily but capable of much wider application. Several territories open. Box No. 2419, Modern Plastics.

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PLASTICS APPLICATIONS RESEARCH: A rapidly growing plastic research group offers attractive positions for applications work on plastics and polymers to suitably qualified chemists or chemical engineers with BS or MS degrees. The function of this research is to develop new materials, study fundamental physical properties and assist in the commercial introduction of new products. The positions carry with them a high degree of personal responsibility, including liaison work with different segments of the company. Send resume to Hooker Electrochemical Company, Industrial Relations Department, Niagara Falls, New York.

PLASTICS SUPERVISOR: Nat'l Paper Container Mfr is setting up small initial injection molding operation to supplement other staple lines. Needs experienced man to establish and supervise department in Los Angeles. Man with few but concentrated years of experience welcome. Excellent opportunity to advance. Send complete details—replies held in strictest confidence. Reply Box 2408, Modern Plastics.

COMPOUNDER: Thoroughly familiar with Phenolic Resin, formulations and production of friction materials. Excellent opportunity for person that thoroughly knows the business. Must move to Texas. Any age considered. Write giving full experience, phone and address to Standco Brake Lining Co., Box 93, Houston, Texas.

TO ANALYZE GROWTH OPPORTUNITIES. We need a man with an educational background which combines chemistry or chemical engineering with business administration or economics. He should have at least four years experience in the chemical industry, preferably with some experience in plastics. He would assist in seeking out and investigating, from a market and financial standpoint, opportunities for growth and diversification within the plastics industry. Personal initiative and a positive approach to this type of development work are of topmost importance. This is an outstanding opportunity for personal professional growth within a vigorous, expanding company. Please send detailed resume of personal data, experience, education and salary requirements to: Spencer Chemical Company, 1004 Baltimore, Kansas City, Missouri.

PLASTIC FINISHING FOREMAN: Leading Chicago area injection molder requires general foreman for finishing operations, including painting, silk screening, hot stamping, etc.; also assembly. Permanent position for man with experience to operate this expanding department. All replies confidential. Salary and Profit Sharing, commensurate with ability. Reply Box 2422, Modern Plastics.

PRODUCTION SUPERVISOR: For Nylon Extrusion Department in Kennett Square, Penna, Plant. Position for man with experience in actual or pilot plant operations involving injection or extrusion moulding. One or two years of college desirable. Send complete resume including present salary to: Manager of Industrial Relations, National Vulcanized Fibre Co., Wilmington 99, Del.

MARKET DEVELOPMENT.
Excellent opportunity for aggressive man to join Spencer Chemical Company's expanding plastics market development program, which will permit him to utilize his sales and technical ability. We are seeking a man who has a chemical or engineering background, and probably three to five years experience. It is desirable that he be familiar with the field of thermoplastics, preferably with thermoplastics processing experience. Please send detailed resume of personal data, experience, education and present salary to:
SPENCER CHEMICAL COMPANY
1004 Baltimore
Kansas City, Missouri
Attention: W. H. Swope, Jr., Personnel Manager

Situations wanted

JOB WANTED. One or two days per week on permanent basis. At present technical director multi-plant AaA-1 company division operating in nonferrous foil rolling, extrusion, coating, laminating. Metals, papers, films, adhesives, inks. Containers, structural, and electronics. Chemical and metallurgical. Classified and commercial. Reply Box 2411, Modern Plastics.

ENGINEER EXECUTIVE: Eleven years experience as works manager and production development engineer. Conversant with production planning, method study, stores, stock control and estimating—costing on batch and flow line production covering general fabrication, impregnating, laminating; p.v.c. sheeting, spreading, slush moulding, and belting; resin glass hand lay up fabricating and premix moulding. Age 32. Reply Box 2417, Modern Plastics.

REINFORCED PLASTICS CONSULTANT: Engineering, Design, Development, Shop Techniques, Plant set-up, cost reduction. Experienced in all phases of manufacture from inception, through design, tooling to finished product. Available to industrial design, engineering consultant, and management consultant firms; companies interested in entering field or those having special problems in reinforced plastics. Ralph W. Lotz, 6621 Ridgeburg Blvd., Cleveland 24, Ohio.

Miscellaneous

USE OUR FACILITIES TO STERILIZE laboratory test or package any plastic product. 84 cu. ft. rectangular bulk sterilizer, complete bacteriological laboratory with animal test room, packaging equipment and personnel can all be arranged for availability. Contact Sterilon Corporation, 500 Northland Avenue, Buffalo 11, New York for full information.

ESTABLISHED TEXAS CORP., dealing in plastics to the oil, electronic and aircraft fields desires to represent firms with lines compatible with present business for Texas or Texas-Oklahoma area. Reply Box 2409, Modern Plastics.

WILL BUY—Injection Molding Plant. Please write in detail. Reply Box 2412, Modern Plastics.

CHEMICAL PLANT.
Delaware—Sale or Rent. Complete for urea or melamine plastics molding compounds. Kettle, Ball Mills, P & S Belt Dryer, Preformers, etc. Large unrestricted acreage. P.O. Box 547, Wilmington, Delaware.

IN SOUTHERN AFRICA: Leading Importers and Representatives of Plastic and Rubber Machinery and Raw Materials would like to obtain manufacturing licenses for Extrusion, Injection, Compression, etc. Anything new—against Royalty or by agreement. Send air mail replies to Ascor, P.O. Box 10734, Johannesberg, South Africa.

IMPORTANT FRENCH FIRM: With excellent references in America, making corrugated fiberglass sheets and equipped with dependable Commercial Department connected with building, wishes to develop range of manufacture and would therefore buy manufacture license or would negotiate agreement with American firm realizing material from plastics for building purposes. Reply Havas International Service No 89/598 rue Vivienne 17, Paris.

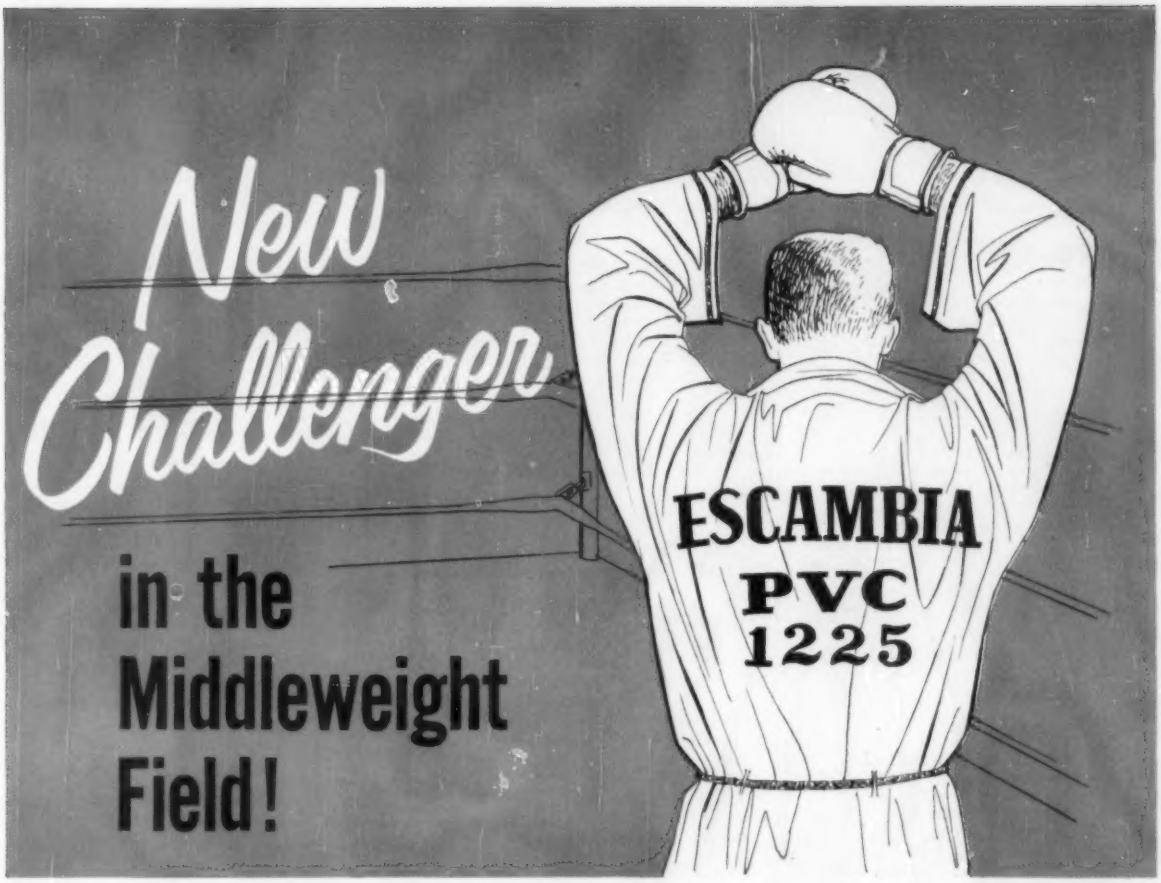
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For further information address Classified Advertising Department,
Modern Plastics, 575 Madison Avenue, N. Y. 22, N. Y.



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- Very Low "Fish-Eye" Count
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- Uniform Particle Size

These same advantages are obtained with the following Escambia resins in the same series:

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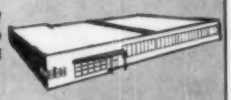




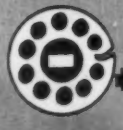
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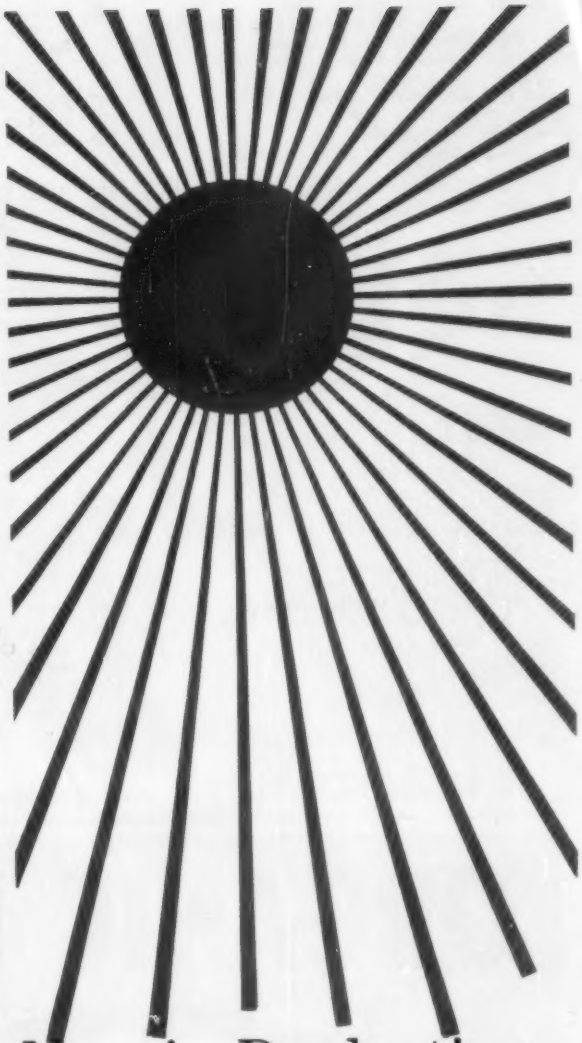
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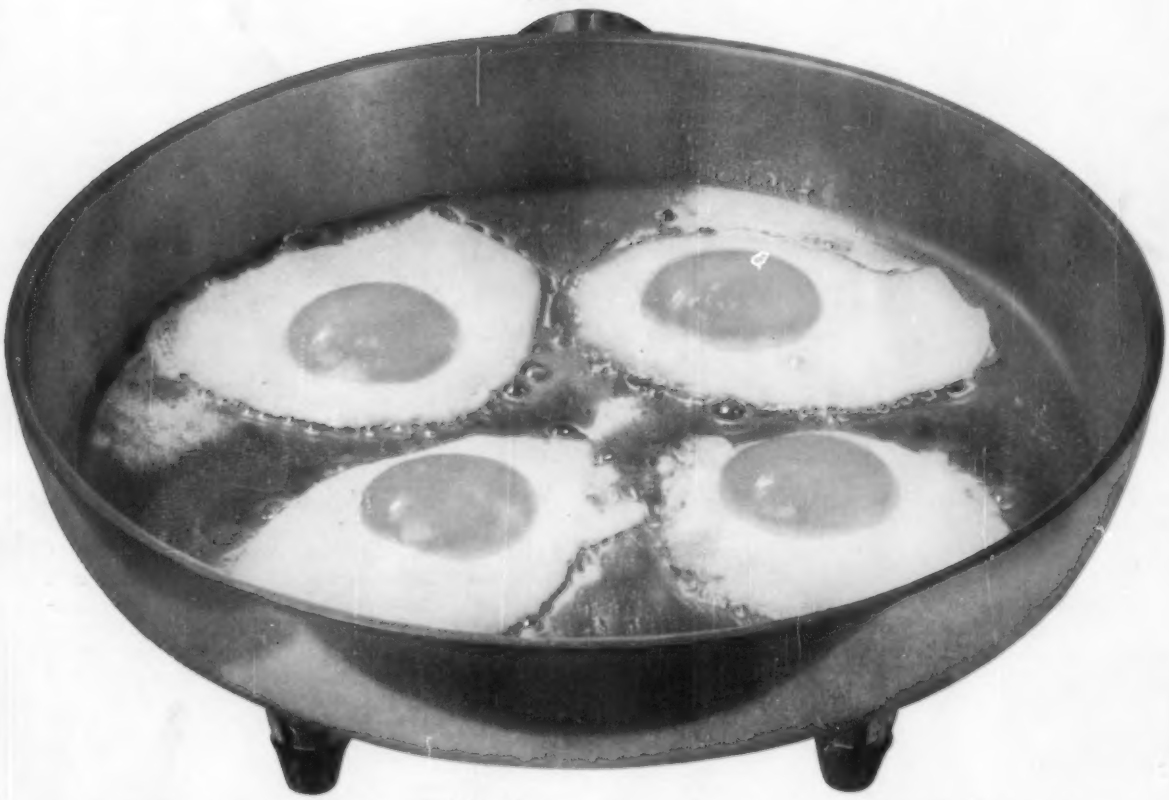


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THE HANDLE OF TOMORROW GOES HERE!



Designers of tomorrow's appliances are writing their specifications today — and they call for better performance, better appearance, of molded parts than ever before. Industrial applications, too, demand higher quality in molded components than most present-day plastics can give.

Two new phenolic compounds from G. E. are expressly engineered to meet these exacting demands. *G-E 12980*, with heat resistance of 500°F and rich, satin-smooth finish for greater sales appeal, is ideally suited to utensil handles and similar appliance parts. *G-E 12981* has medium heat resistance (400°F) and somewhat higher strength than *G-E 12980*. It is recommended for industrial applications where these properties are desirable. Both compounds feature low gravity, good dimensional stability, fast preheat and cure.

Write for samples and complete technical information on these newest additions to the G-E phenolics line. GENERAL ELECTRIC COMPANY, Chemical Materials Dept. Section MP-7, Pittsfield, Mass.

Progress In Phenolics

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